CHAPTER 1

ADMINISTRATION

101.0 Title

These regulations shall be known as the "~~Uniform~~ City of Houston Mechanical Code," may be cited as such, and will be referred to herein as "this code."

The Construction Code of the City of Houston, Texas, collectively includes this volume and certain other codes, pamphlets, specifications and documents that are adopted in or by reference through the Adopting Ordinance, which appears in the preamble of the Building Code.

103.0 Scope

103.1 General. The provisions of this code shall apply to the erection, installation, alteration, repair, relocation, replacement, addition to, use or maintenance of any heating, ventilating, cooling, refrigeration systems, incinerators or other miscellaneous heat-producing appliances within this jurisdiction.

Additions, alterations, repairs and replacement of equipment or systems shall comply with the provisions for new equipment and systems, except as otherwise provided in Section 104.0 of this code.

Where, in any specific case, different sections of this code specify different materials, methods of construction or other requirements, the most restrictive shall govern. Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall be applicable.

The design and testing of equipment regulated by this code shall be subject to the approval of the Administrative Authority.

The standards contained in Appendix A shall be considered as part of this code. Appendix B contains recommended practices which shall not apply unless specifically adopted. Appendix C contains gas venting tables and is intended to serve only as a guide. Appendix D contains conversion tables and a table for determining the approximate minimum thickness for carbon sheet metal.

103.2 Most Restrictive. Where, in any specific case, different provisions of the Code of ordinances, the Building Code of the City of Houston, the Electrical Code of the City of Houston, the City of Houston Plumbing Code, the City of Houston Fire Code and this code specify different materials, methods of construction or other requirements, the most restrictive shall govern. Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall be applicable.

103.3 *International Residential Code*. Mechanical systems for detached one- and two-family dwellings and multiple single-family dwellings (townhouses) not more than three stories high with separate means of egress and their accessory structures shall comply with the *2000 International Residential Code for One- and Two-Family Dwellings* as adopted by the State of Texas in Subchapter G of Chapter 214 of the Texas Local Government Code and amended by this jurisdiction. Mechanical systems for residential occupancies to which the *International Residential Code* does not apply shall be governed by this code.

103.4 Energy. *The 2000 International Energy Conservation Code* has been adopted by the State of Texas pursuant to Chapter 388 of *the Texas Health and Safety Code*. *The 2000 International Energy Conservation Code* and any amendments adopted as authorized by state law shall be enforced by this jurisdiction in accordance state law.

104.6 Retroactive Provisions. Notwithstanding any other provision of this section, those provisions of this code that are designated as being "retroactive" shall apply to existing installations and alteration thereof.

108.3 Right of Entry. When it is necessary to make an inspection to enforce the provisions of this code, or when the Administrative Authority has reasonable cause to believe that there exists in a building or upon a premises a condition which is contrary to or in violation of this code which makes the building or premises unsafe, dangerous or hazardous, the Administrative Authority may enter the building or premises at reasonable

times to inspect or to perform the duties imposed by this code, provided that if such building or premises be occupied that credentials be presented to the occupant and entry requested. If such building or premises be unoccupied, the Administrative Authority shall first make a reasonable effort to locate the owner or other person having charge or control of the building or premises and request entry. If entry is refused, the Administrative Authority shall have recourse to the remedies provided by law to secure entry.

When, due to emergency, immediate entry is necessary to make an inspection to protect life or property or when the Administrative Authority shall have first obtained a proper inspection warrant or other remedy provided by law to secure entry, no owner or occupant or person having charge, care or control of any building or premises shall fail or neglect, after proper request is made as herein provided, to promptly permit entry therein by the Administrative Authority for the purpose of inspection and examination pursuant to this code.

108.4 Stop Orders. When any work is being done contrary to the provisions of this code, the Administrative Authority may order the work stopped by notice in writing served on any persons engaged in the doing or causing such work to be done, and such persons shall forthwith stop work until authorized by the Administrative Authority to proceed with the work.

At the time such stop order is issued, the person doing the work and the permit holder shall be given notice of a right to a hearing on the matter pursuant to Section 108.10 of this code. On request, such a hearing shall be held within three business days unless the permit holder or person doing the work requests an extension of time. Any stop order that has been issued shall remain in effect pending any hearing requested on the matter unless the stop order is withdrawn by the Administrative Authority.

108.5 Authority to Disconnect Utilities in Emergencies. The Administrative Authority or the Administrative Authority's authorized representative shall have the authority to disconnect fuel gas utility service, or energy supplies to a building, structure, premises or equipment regulated by this code in case of emergency ~~where~~ when necessary to

eliminate an immediate hazard to life or property. The Administrative Authority shall, whenever possible, notify the serving utility, the owner and occupant of the building, structure or premises of the decision to disconnect prior to taking such action, and shall notify such serving utility, owner and occupant of the building, structure or premises in writing of such disconnection immediately thereafter.

The notice shall also inform the owner and the occupant of the building (or the user if the mechanical equipment is not within a building) of a right to a hearing on the matter pursuant to Section 108.10 of this code. On request, such a hearing shall be conducted within three business days unless the owner requests an extension of time.

108.6 Authority to Condemn Equipment. When the Administrative Authority ascertains that ~~any~~ equipment, or portion thereof, regulated by this code has become hazardous to life, health or property, the Administrative Authority shall order in writing that the equipment either be removed or restored to a safe or sanitary condition, as appropriate. The written notice shall contain a fixed time limit for compliance of not less than three (3) days ,with such order and shall inform the owner and the occupant of the right to a hearing on the matter pursuant to Section 108.10 of this code. Persons shall not use or maintain defective equipment after receiving a notice.

When equipment or an installation is to be disconnected, written notice of the disconnection and causes therefor shall be given within twenty-four (24) hours to the serving utility, the owner and occupant of the building, structure or premises. When any equipment is maintained in violation of this code, and in violation of a notice issued pursuant to the provisions of this section, the Administrative Authority shall institute an appropriate action to prevent, restrain, correct or abate the violation.

108.8 Liability. ~~The Administrative Authority charged with the enforcement of this code acting in good faith and without malice in the discharge of the duties required by this code or other pertinent law or ordinance shall not thereby be rendered personally liable for damages that may accrue to persons or property as a result of an act or by reason of an act or omission in the discharge of such duties. A suit brought against the Administrative~~

~~Authority or employee because of such act or omission performed by the Administrative Authority or employee in the enforcement of any provision of such codes or other pertinent laws or ordinances implemented through the enforcement of this code or enforced by the code enforcement agency shall be defended by this jurisdiction until final termination of such proceedings, and any judgment resulting therefrom shall be assumed by this jurisdiction.~~

Except as otherwise provided by law, the Administrative Authority shall not be personally liable in damages for any act or omission arising out of any official action taken to implement and enforce the provisions of this code. Additionally, except as otherwise provided by law, the Administrative Authority shall not be personally liable in damages for any action or omission taken in the course and scope of employment. Where and to the extent consistent with the provisions of Article X of Chapter 2 of the City Code, the jurisdiction shall provide legal representation and indemnification for any suit brought against the Administrative Authority or other employees because of acts or omissions performed in the enforcement of this code.

This code shall not be construed to relieve from or lessen the responsibility of any person owning, operating or controlling any equipment regulated herein for damages to persons or property caused by defects, nor shall the code enforcement agency or its parent jurisdiction be held as assuming any such liability by reason of the inspections authorized by this code or any permits or certificates issued under this code.

108.10 Hearing Procedures; Notices

108.10.1 Hearing Notices. Unless otherwise provided in this code, whenever notice is to be given to any person concerning the right to a hearing or any other matter, the notice may be given by personal delivery or by certified mail, return receipt requested.

If the notice is being given to an applicant for a jurisdiction license or to a licensee or to a state license registrant, the notice may be mailed to the address set out in the application for the registration or license unless the applicant or registrant has given the Administrative Authority written notice of a change of address, under which circumstances any notice concerning a hearing shall be sent to the most recent

address shown on the notice. If any notice mailed to an applicant for a license or to a licensee or registrant is returned without delivery, notice shall be effective if posted where the public may observe it in the Permit Office.

If notice is being given to a building owner or to a tenant therein and the Administrative Authority is unable to determine the name or address of such person after checking the building and the applicable records of the Planning and Development Department, the County Appraisal District, the electrical utility company, the gas utility company, and the water service provider, notice shall be mailed to the billing addresses of the building as shown on the records of the electrical company and the gas company and shall be posted on or in view of each entrance to the building. Additionally, if any notice is mailed to a building owner or a building tenant and is returned without delivery, notice shall be effective if posted on or in view of each entrance to the building.

108.10.2 Hearings. Except where otherwise specifically provided, all hearings held pursuant to this code shall be conducted by the jurisdiction's director of Planning and Development or a representative, who shall hereinafter be referred to as the hearing official. The director shall not designate any person to be a hearing official under this code who has taken any part in the investigation of the matter that is the subject of the hearing or any person who directly supervised the investigation. The hearing official shall consider only the evidence presented at the hearing in rendering a decision. The decision of the hearing official shall be set forth in writing and shall be served on each party in the same manner as a notice of a right to a hearing.

110.0 ~~Board of Appeals~~ Boards and Licenses

110.1 General. ~~In order to hear and decide appeals of orders, decisions or determinations made by the Administrative Authority relative to the application and interpretations of this code, there shall be and is hereby created a Board of Appeals consisting of members who are qualified by experience and training to pass upon matters pertaining to mechanical design, construction and maintenance and the public health aspects of mechanical 99~~

~~systems and who are not employees of the jurisdiction. The Administrative Authority shall be an ex-officio member and shall act as secretary to said board but shall have no vote upon any matter before the board. The Board of Appeals shall be appointed by the governing body and shall hold office at its pleasure. The board shall adopt rules of procedure for conducting its business and shall render all decisions and findings in writing to the appellant with a duplicate copy to the Administrative Authority.~~

The Mechanical Code Review Board or the Boiler Code Review and Licensing Board shall hear and decide appeals of orders, decisions or determinations made by the Administrative Authority relative to the application and interpretation of this code. See Sections 121 and 122.

110.2 Limitations of Authority. The ~~Board of Appeals~~ aforesaid boards shall have no authority relative to interpretation of the administrative provisions of this code nor shall the boards be empowered to waive requirements of this code.

111.0 Violations and Penalties

111.1 General. It shall be unlawful for a person, firm or corporation to erect, construct, enlarge, alter, repair, move, improve, remove, convert or demolish, equip, use or maintain mechanical systems or equipment or cause or permit the same to be done in violation of this code.

111.2 Penalties. Where no specific penalty is otherwise provided in this code, the violation of any provision of this code shall constitute a misdemeanor punishable upon conviction by a fine of not less than $250.00 and not more than $2,000.00. Each day that any violation continues shall constitute and be punishable as a separate offense. Where any conduct in violation of this code also constitutes a violation of state penal law, then the offense shall be punishable as provided in the applicable state law. In prosecutions under this code, the various provisions hereof that are designated as an "exception" or "exceptions" shall not be treated as exceptions within the meaning of Section 2.02 of the

Texas Penal Code, and instead, they shall constitute defenses to prosecution within the meaning of Section 2.03 of the Texas Penal Code.

111.3 Mechanical Integrity. All persons, firms, and corporations installing, altering, repairing or demolishing systems, appliances, components and equipment regulated by this code must maintain the mechanical integrity of the work that they perform in accordance with the provisions of this code. Failure to maintain mechanical integrity shall constitute a violation of this code subject to the penalties set forth in Section 111.2.

113.2 Plans and Specifications. Plans, engineering calculations, diagrams and other data shall be submitted in ~~one or more~~ two sets with each application for a permit. When such plans are not prepared by an architect or engineer, the Administrative Authority may require any applicant submitting such plans or other data to demonstrate that state law does not require that the plans be prepared by an architect or engineer. The Administrative Authority may require plans, computations and specifications to be prepared and designed by an engineer or architect licensed by the state to practice as such even if not required by state law.

Exception: The Administrative Authority may waive the submission of plans, calculations or other data if it is found that the nature of the work applied for is such that reviewing of plans is not necessary to obtain compliance with this code.

113.3 Information on Plans and Specifications. Plans and specifications shall be drawn to scale ~~upon substantial paper or cloth~~ and shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that it will conform to the provisions of this code and relevant laws, ordinances, rules and regulations.

~~Plans for buildings more than two stories in height of other than Group R, Division 3 and Group U Occupancies shall indicate how required structural and fire-resistive integrity will be maintained where a penetration will be made for electrical, mechanical, plumbing and communication conduits, pipes and similar systems.~~

~~The installer shall submit plans showing the proposed installation, indicating the location of the heater and such accessories as may be required to ensure the proper and safe performance of its function.~~

113.3.1 Penetrations Detailed. Plans for buildings more than two stories in height of other than Group R, Division 3 Occupancy and accessory structures thereto shall indicate how required structural and fire-resistive integrity will be maintained where a penetration will be made for electrical, mechanical, plumbing and communication conduits, pipes and similar systems.

113.3.2 Direct-Fired Gas Makeup and Industrial Air Heaters. The installer shall submit plans showing the proposed installation, indicating the location of the heater and such accessories as may be required to ensure the proper and safe performance of its function.

114.4 Expiration. ~~Every permit issued by the Administrative Authority under the provisions of this code shall expire by limitation and become null and void if the work authorized by such permit is not commenced within 180 days from the date of such permit, or if the work authorized by such permit is suspended or abandoned at any time after the work is commenced for a period of 180 days. Before such work can be recommenced, a new permit shall be first obtained, and the fee therefor shall be one-half the amount required for a new permit for such work, provided no changes have been made or will be made in the original plans and specifications for such work and provided further that such suspension or abandonment has not exceeded one year. No permit shall be extended more than once. In order to renew action on a permit after expiration, the permittee shall pay a new full permit fee.~~

~~A permittee holding an unexpired permit may apply for an extension of the time within which work may be commenced under that permit when the permittee is unable to commence work within the time required by this section for good and satisfactory reasons. The Administrative Authority may extend the time for action by the permittee for a period~~

~~not exceeding 180 days upon written request by the permittee showing that circumstances beyond the control of the permittee have prevented action from being taken.~~

For the purposes of this subsection, the determination whether work has commenced under a permit or whether work has been abandoned under a permit shall be based upon whether the permit holder requests an inspection of the work performed under the permit by the Administrative Authority. If work is not commenced under a permit within 180 days of the date of issuance or is abandoned at any time for a period of 180 consecutive days, the permit shall lapse. An elapsed permit shall expire 180 days following the date that it lapsed unless, before the 180th day following the date that the permit lapsed, the permit holder obtains reactivation of the permit by:

1. Requesting reactivation of the permit by the Administrative Authority, and
2. Requesting an inspection by the Administrative Authority of work performed under the permit.

A permit may only be reactivated one time, and it shall expire if the work is again abandoned for a period of 180 consecutive days. In order to recommence work under an expired permit, the permit holder shall pay the full permit fee applicable and submit plans that comply with this code for to the previously uninspected portion of the work.

Exception: The Administrative Authority may upon request perform a final inspection of work for which the permit has expired or reactivate a permit for the purpose of issuing a certificate of occupancy or a certificate of compliance.

115.1 General. Fees shall be assessed in accordance with the provisions of this section ~~and as set forth in the fee schedule Table 1-1. The fees are to be determined and adopted by this jurisdiction.~~

115.2 Permit Fees. The fee for each permit shall be as set forth in ~~Table 1-1~~. Section 117 of the Building Code. That section also sets forth other fees that are applicable to this code, such as reinspection fees.

115.3 Plan Review Fees. ~~When plans or other data are required to be submitted by Section 113.2, a plan review fee shall be paid at the time of submitting plans and specifications for review. The plan review fees for mechanical work shall be determined and adopted by this jurisdiction.~~

~~The plan review fees specified in this subsection are separate fees from the permit fees specified in Section 115.2 and are in addition to the permit fees.~~

~~When plans are incomplete or changed so as to require additional plan review, an additional plan review fee shall be charged at the rate shown in Table 1-1.~~

When approved plans are lost or changed so as to require an additional plan review or when a plan review is required and there is no building permit required, a plan review fee shall be charged at the rate shown in Section 117 of the Building Code.

115.6 Fee Refunds

The Administrative Authority may authorize the refunding of any fee paid hereunder which was ~~erroneously~~ paid or collected due to an error by one or more jurisdiction employees. This provision shall not be applicable if the error occurred due to incorrect information provided by the applicant.

115.6.1 The Administrative Authority may authorize refunding of not more than ~~a percentage,~~ 90 percent of the amount in excess of $25.00 of the permit fee paid ~~as determined by this jurisdiction,~~ when no work has been done under a permit issued in accordance with this code. If work has been done under the permit, no refund may be authorized.

115.6.2 Reserved. ~~The Administrative Authority may authorize refunding of not more than a percentage, as determined by this jurisdiction, when an application for a permit for which a plan review fee has been paid is withdrawn or canceled before any plan review effort has been expended~~.

116.2 Operation of Mechanical Equipment. The requirements of this section shall not be considered to prohibit the operation of mechanical systems installed to replace existing equipment or fixtures serving an occupied portion of the building ~~in the event~~ provided that a request for inspection of such equipment or fixture has been filed with the Administrative Authority not more than forty-eight (48) hours after such ~~replacement work is completed~~, equipment is made operational and before any portion of such mechanical system is concealed by any permanent portion of the building. It shall be a violation of this code, subject to the penalties set forth in Section 111.2, for a permit holder to fail to make all necessary arrangements for inspection and request the inspection not later than the next work day immediately following the aforementioned 48 hour period.

116.3 Testing of Equipment. Refrigeration equipment regulated by this code shall be tested and approved as required by Section ~~1120.0~~ 1123 of this code.

Steam and hot water boilers and piping shall be tested and approved as required by Sections 1023 and 1201.2.8, ~~1201.3.6~~ and 1207.0 of this code.

Where applicable (see Section 103.0), fuel gas piping shall be tested and approved as required by Section 1304.0 of Appendix B of this code.

118.0 Emergency Work

118.1 General. It is an exception to any provision of this code or of the Construction Code of the City of Houston that requires the issuance of a permit under this code prior to commencing work or that imposes an additional fee for work commenced without a permit being first obtained that:

1. The work involved the emergency repair or replacement of an existing air conditioning, heating, ventilation or refrigeration system;
2. The work was required to be commenced immediately in order to protect property or to preserve the health of persons;
3. Notice was given to the Administrative Authority by mail, telephone, fax or other approved method when the work was commenced; and
4. A permit was obtained as provided in Subsection 118.2.

The Administrative Authority shall promulgate regulations and forms as required to administer this Section.

118.2 Time Limit for Obtaining Permit. In order to avoid penalties for failure to obtain a permit prior to commencing such job, the licensed air conditioning and refrigeration contractor shall, in addition to complying with Section 118.1, obtain a permit for the job within 48 hours after 8:00 am, of the first day that the jurisdiction's permit office is open for business after the date on which the contractor commences such alteration or installation.

118.3 Operation of System. If the alteration or installation is completed prior to the time that the licensed air conditioning and refrigeration contractor is required to obtain a permit under the provisions hereof, at the contractor's sole risk and responsibility for all injuries and damages that might result therefrom to persons and property, the contractor may place the system or installation into operation, provided that the contractor remains at the job site and checks its operation for a period of at least 15 minutes before leaving. The contractor shall instruct the occupant or other person in charge of the premises regarding the manner in which the equipment or system may be immediately shut off in case of malfunction, and shall provide the person with a telephone number, or numbers, where the licensed contractor can be reached in case of an emergency resulting from operation of the system or installation prior to the inspection by the jurisdiction.

118.4 Emergency Appeal. In the event of a dispute between the jurisdiction's inspector and the licensed air conditioning and refrigeration contractor doing the job as to the existence of the emergency authorizing the commencing of the job without a permit, the dispute shall be first considered by the Administrative Authority, and if the contractor is dissatisfied with the decision of the Administrative Authority, the contractor may appeal that decision to the Mechanical Code Review Board or Boiler Code Licensing and Review Board as applicable, for its consideration and decision. In reviewing the decision of the Administrative Authority, the board shall grant both parties involved a full opportunity to

present their respective sides of the issue, including the presentation of evidence and testimony, and the board shall base its decision on such evidence and testimony.

119.0 Temporary Operation Permit

119.1 General. Any heating, ventilating, refrigerating or air conditioning system being altered or installed by authority of a permit issued under the provisions of this code may be operated for limited periods of time for testing purposes only prior to passing final inspection, on the following conditions:

The licensed air conditioning and refrigeration contractor in whose name said permit is issued shall request that the Administrative Authority inspect the system for approval of such operation.

If on inspection the system is approved for operation for testing purposes, the jurisdiction inspector shall indicate in writing on the permit the length of time that said system may be operated for testing purposes, the length of time shall be determined from the size and type of system and the extent of the installation or alteration involved.

On the date that the length of time as shown on said permit for operation for testing purposes only expires, the system shall be given a final inspection, and if the system fails to be approved a reinspection fee will be charged on all subsequent inspections until the system is finally approved as complying with the requirements of this code.

119.2 Extension of Time. The time permitted for operating for testing purposes may be extended by the building official of the jurisdiction when necessary to complete the testing of the system in order to determine that it is operating safely. The extension of time shall be noted in writing on the permit, and at the expiration of that time, a final inspection will be required to be made as provided for above.

For the fee for obtaining a temporary operation permit, see Section 117 of the Building Code.

120.0 Approvals

Approval of the installation of mechanical equipment, or the alteration of any existing installation, shall be rendered only when the work is installed or performed in accordance with the provisions of this code.

Approval of a permit covers only work authorized by the permit issued for the installation or alteration of the mechanical equipment involved.

Part IV-Boards and Licensing

121.0 Mechanical Code Review Board

121.1 Creation of Board. There is hereby created a Mechanical Code Review Board hereinafter called "the board," consisting of seven members. Each member of the board except the members in Positions Nos. 1 and 2 shall be appointed by the Mayor and confirmed by the City Council. The Mayor shall designate a member to be chairman. The contractor members filling Positions Nos. 5 and 6 shall have been actively engaged in the air conditioning business in the jurisdiction for least five years prior to the date of their appointment.

The positions on said board shall be filled as follows:

Position No. 1 shall be filled by the Building Official of the jurisdiction.

Position No. 2 shall be filled by the Fire Marshal of the jurisdiction.

Positions No. 3 and 4 shall each be filled by a registered professional engineer licensed by the State of Texas who are actively engaged in mechanical engineering.

Position No. 5 shall be filled by a duly licensed Class A air conditioning and refrigeration contractor licensed under the Texas Air Conditioning and Refrigeration Contractor License Law.

Position No. 6 shall be filled by a duly licensed Class B air conditioning and refrigeration contractor licensed under the Texas Air Conditioning and Refrigeration Contractor License Law.

Position No. 7 shall be filled by a representative of the public generally.

The Building Official and the Fire Marshal each, from time to time, may designate in writing a person under their supervision to act in their places as their duly authorized representatives. The representatives shall enjoy all rights and privileges of the position. A copy of such a designation, specifying the dates any such person shall act as representative of the Building Official or of the Fire Marshal, shall be filed with the minutes of the board.

The terms of office for the appointees to Positions Nos. 3, 5, and 7 on the board will expire on the second day of January of odd-numbered years, and the terms of office for the appointees to Positions Nos. 4 and 6 will expire on the second day of January on even-numbered years. However, each member shall continue in office until a successor has been appointed and qualified.

Those members of the board who hold membership on the board by virtue of their employment classification with the jurisdiction will hold such membership as long as they are so classified.

The amendment of this code section and change of name of the board, which was formerly known as the Air Conditioning Board, shall not terminate the term of office of any person currently serving on the board. Any person who is currently serving on the board shall continue to serve in the position for which he was appointed and confirmed until a successor is appointed and qualified.

In addition to other qualifications hereinabove required, each member of the board shall be a citizen of the United States. All members of the board shall be selected on the basis of their technical and professional qualifications, except that the appointee to Position 7 is not required to have the technical and professional qualifications required for other members of the board. Each member of the board shall be subject to removal by the Mayor. Four members of the board at any meeting shall constitute a quorum for transaction of all business of the board. A majority vote of the members present at any meeting at which a quorum is present shall prevail.

Whenever any position on the board becomes vacant by reason of death, resignation or removal, said vacancy shall be filled for the unexpired term of the member being replaced.

Should a vacancy occur on the board, the Mayor shall appoint, with the approval of the City Council, another qualified person to serve the unexpired term of the vacancy.

The board shall hold regular annual meetings in Houston, Texas, the exact time and place to be designated by the chairman of the board, who is also authorized to call special meetings when deemed necessary. The Building Official, or a duly authorized representative, shall act as secretary of the board. Each member of the board shall receive $50.00 for each meeting the member attends (not to exceed three meetings in a calendar month) at which a quorum is present, provided, however each member of the board who is an employee of the jurisdiction will be paid only for those meetings they attend that are neither held during nor continue beyond his or her regular working hours.

The secretary of the board shall keep the minutes of the board meetings and other business of the board, including correspondence received and sent by the board. The minutes of the board shall be public records available for inspection by the public at all reasonable times in the presence of the secretary of the board or in the presence of any member of the board.

121.2 Duties. The board is hereby authorized and it shall be its duty to serve as the Board of Appeals for matters relating to the provisions of this code, and to serve in an advisory capacity to the Administrative Authority in technical matters pertaining to provisions of this code. The board is hereby additionally authorized to perform such other duties as specified in this division and to make recommendations to City Council regarding the provisions of this code pertaining to or affecting air conditioning, ventilation, or refrigeration.

Exception: As provided by Section 122 of this code, matters within the jurisdiction of the Boiler Code Review and Licensing Board shall be heard by that board.

121.3 Approval of New Materials. A person, firm, or corporation (hereinafter called "person") desiring approval of any material, device, fixture, method of assemblage, installation, appurtenance, or appliance that is a part of or pertains to heating, air conditioning, ventilation, refrigeration or heat-producing appliances or systems (hereafter individually and collectively referred to as "item") may submit the item to the Administrative

Authority for approval together with a written application containing such information as the Administrative Authority may require for determination of approval under Section 105.

If the Administrative Authority denies a request for an approval, the person who made the request may appeal that decision by delivering a written notice of appeal to the secretary of the board within 10 days of the date the notice of the Administrative Authority's decision was either hand delivered or mailed to such person. Upon receipt of the notice of appeal, the board shall set the matter for hearing. The board may request any additional tests be conducted that it finds are necessary to determine whether the Administrative Authority's decision should be upheld or overturned. All such tests shall be at the expense of the person requesting the approval and the burden shall be on that person to show that the decision of the Administrative Authority should be overturned.

The decision of the board upholding or overturning the decision of the Administrative Authority shall be set out in the minutes of the board. If the board overturns the decision of the Administrative Authority, it shall set forth in its minutes any conditions or limitations to which the approval is made subject.

121.4 License Required. Except as otherwise provided therein, no person who does not hold a current, valid and applicable license under the Texas Air Conditioning and Refrigeration Contractor License Law shall install, alter or repair any heating, ventilating, air conditioning or refrigeration systems, or any part thereof, or obtain any permit to do so.

Note: The Texas Air Conditioning and Refrigeration Contractor License Law, which is codified as art. 8861 of the Texas Revised Civil Statutes, and will be repealed and replaced by Chapter 1302 of the Texas Occupations Code, effective June, 1, 2003, includes certain exemptions from the requirement of obtaining a state license, which will be honored by this jurisdiction. These exemptions include: work performed by homeowners on their own homes, certain maintenance work by employees of the property owner or management company, certain work performed by employees of regulated electric and gas utility companies, and certain work performed by licensed professional engineers in connection with their business operations.

121.5 State License Notification Requirement. Each person licensed under the Texas Air Conditioning and Refrigeration Contractor License Law shall notify and register his or her notification with the Administrative Authority in a form and manner prescribed by the Administrative Authority prior to performing any work pertaining to that license within the jurisdiction. The notification shall be duly registered and maintained on file within the offices of the Mechanical Inspection Section, Building Inspection Division, Department of Planning and Development. The fee for initial notification registration shall be $25.00. A notification registration maintenance fee of $25.00 shall be paid annually thereafter. Each notification registration shall expire on December 31 of each year. Additionally, a notification registration shall expire upon the registrant's failure to provide proof of current insurance coverage or proof of license renewal.

A notification registration initiated or reinstated during the renewal period will become due for renewal on December 31 of the following calendar year.

121.6 Liability Insurance. Each person who is required to register shall, upon registration and continuously thereafter, maintain proof of current liability insurance coverage in the amount and form specified in applicable state laws and regulations. The proof shall be in the form of a copy of the certificate furnished to the state and evidence that the carrier of the insurance will provide 10 days' notice to the Administrative Authority in the event that the policy is reduced or terminated prior to the expiration date specified on the certificate.

121.7 Violations. It shall be unlawful for any person, partnership, firm or corporation, who is not licensed under the Texas Air Conditioning and Refrigeration Contractor License Law to display a sign or advertise in any other manner that such person, partnership, firm or corporation is authorized to engage in the business of an air conditioning and refrigeration contractor.

It shall be unlawful for a licensed air conditioning and refrigeration contractor to permit a license to be used in any manner contrary to any of the provisions of this code; or to obtain a permit, required under the provisions hereof, in such person's name or allow the use of his or her name directly or indirectly by another person for the purpose of obtaining a

permit when the licensed air conditioning and refrigeration contractor does not intend to or does not, in fact, do or supervise the work authorized by the permit; or to take out permits for air conditioning work to be done by a person, firm, partnership or corporation other than the person, firm, partnership or corporation by whom the permittee is employed.

Licensed air conditioning and refrigeration contractors shall not be simultaneously employed by, or work for, more than one business entity for the purpose of obtaining permits under this code or for the purpose of doing or supervising work that can be done only by authority of a permit obtained under the provisions of this code.

121.8 Identification of Vehicles and Sites. Each vehicle used in conjunction with air conditioning and refrigeration contracting shall be marked as required by Title 16 Texas Administration Code Section 75.70(i), which provides that "[e]ach licensee and air conditioning and refrigeration contracting company shall display the license number and company name in letters not less than two inches high on both sides of all vehicles used in conjunction with air conditioning and refrigeration contracting. When an unlicensed subcontractor is at a job site not identified by a marked vehicle, the site shall be identified either by a temporary sign on the subcontractor's vehicle or on a sign visible and readable from the nearest public street containing the contractor's license number and company name."

121.9 Contractor Records. Each time that a licensed air conditioning and refrigeration contractor or any employee thereof does any installation, replacement, or repair of any type on any air conditioning, refrigeration, ventilation or heating system, or combination of such systems, the contractor shall make a record of the work. The records shall be readily made available upon request for inspection and copying by the Administrative Authority, and the records must be held on file for at least two years. Before leaving the premises where the work is performed, the contractor shall deliver one copy of the record to the owner or the owner's representative. These records shall contain the following information:

1. Name and address of licensed contractor.
2. License number of licensed contractor.

3. Name of owner.
4. Date.
5. General nature of work performed.
6. Any other information required by applicable provisions of the Texas Air Conditioning and Refrigeration Contractor License Law and regulations issued thereunder.

122.0 Boiler Code Review And Licensing Board

122.1.1 Creation and Composition. There is hereby created a Boiler Code Review and Licensing Board consisting of five members, which is herein referred to as the "board." The members in Positions Nos. 1 through 4 of the board shall be appointed by the Mayor and confirmed by the City Council. The Mayor shall designate a member to be chairman. Each of the five positions shall be filled as follows:

Position No. 1 shall be filled by a registered professional engineer licensed by the State of Texas who is actively engaged in the design of mechanical systems using boilers as a source of heat energy.

Position No. 2 shall be filled by an owner, partner, officer, or manager of a firm that is actively engaged in the manufacture, sale, repair or installation (or combination thereof) of boilers.

Position No. 3 shall be filled by a licensed stationary engineer who has held a first-grade license issued by the jurisdiction for not less than a 10 years.

Position No. 4 shall be filled by a person who is an owner, partner, officer, or manager of a firm that is the user of a boiler or boilers.

Position No. 5 shall be filled by the Building Official of the jurisdiction.

The Building Official, from time to time, may designate in writing a member of the jurisdiction's Boiler Inspection Section to act in his or her place as a duly authorized representative. The representative shall enjoy all rights and privileges of the position. A copy of the designation, specifying the dates such a person shall act as representative of the Building Official, shall be filed with the minutes of the board.

122.1.2 Appointments, Removals, etc. The terms of office for the appointees to positions Nos. 1 and 3 shall expire on the second day of January of odd-numbered years, and the terms of the appointees to Positions Nos. 2 and 4 shall expire on the second day of January of even-numbered years; however, each member shall continue in office until a successor shall have been appointed and qualified. The adoption of this code shall not terminate the term of office of any person currently serving in any position of the board. Any appointed member who is currently serving on the board shall continue to serve in the position for which he or she was appointed and confirmed until a successor is appointed and confirmed by City Council under this code. Each appointed member of the board shall be subject to removal at any time by the Mayor. Each member of the board shall receive $50.00 for services for each meeting of the board the member attends at which a quorum is present, provided, however, each member of the board who is an employee of the jurisdiction shall be paid only for those meetings that are neither held during nor continue beyond his or her regular working hours.

Three members of the board present at any meeting shall constitute a quorum for the transaction of all business of the board. A majority vote of board members present at any meeting at which a quorum is present shall prevail.

The board shall meet regularly twice each month. The chairman shall have the power to call a special session of the board when deemed necessary, but no more than three meetings may be held in any month. In the absence of the chairman at any meeting, the board members present may select a temporary chairman for that meeting.

122.1.3 Restriction on Participation in Certain Matters. No board member shall vote on any matter or, as a board member, participate in the discussion of any matter in which the member has a personal or financial interest other than as a member of a class or group, each member of which will be affected substantially to the same extent by the board's action or decision in the matter as will the other members of the class or group. (For restrictions on jurisdiction officials, see Chapter 171 of the Local Government Code.)

122.1.4 Records. The board shall keep or cause to be kept a written record of its meetings. The records shall be open to inspection by the public at all reasonable times.

122.1.5 Administrative Authority. The Administrative Authority is hereby charged with the duty of determining that the provisions of this Code are being complied with. The Administrative Authority shall prepare and maintain a record of all persons qualified to install and operate boilers under the provisions of this code within jurisdiction. Also, the Administrative Authority or duly appointed representative shall act as secretary to the board at all meetings.

122.1.6 Examinations. The board shall develop and administer examinations for stationary engineer's licenses. The examinations shall determine the applicants' capacity and ability to understand and operate safety boilers, steam equipment and the various auxiliary machinery, appliances and appurtenances in conjunction with the operation of such boilers and steam equipment. The board shall perform such other duties as may be required of it by the governing body and Mayor of the jurisdiction. The board shall adopt rules and regulations which, insofar as they relate to boilers, shall conform to the ASME Code and shall not be inconsistent with the terms and provisions of this code.

122.1.7 Review and Action of the Boiler Board. Disputes arising between inspectors of the jurisdiction and any person or persons concerning the application of the provisions of this code to the installation of boiler facilities to serve property of such person or persons may be submitted to the Administrative Authority. An interested party (other than an inspector of the jurisdiction) who is dissatisfied with the decision of the Administrative Authority in the matter may appeal that decision to the board. Upon such an appeal, each party to the dispute shall be entitled to present his or her side of the matter to the board, and the board shall render its decision on the matter based on its interpretation of applicable provisions of this code.

The board shall have the power by a majority vote to revoke or cancel a stationary engineer's license or operator's license or operator's permit issued to a person for

dishonesty, incompetency or misconduct connected with the discharge of his or her duties as such or for neglect of his or her duties, but no license or permit shall be permanently revoked or canceled without first giving the accused an opportunity to be heard in his or her defense.

The Administrative Authority of the jurisdiction shall have the authority to suspend for just cause a stationary engineer's license or operator's license or operator's permit. The holder of a license or permit so suspended shall not be permitted to act under the authority of such license or permit while such license or permit is suspended, but shall be given an opportunity to be heard by the board in his or her defense within five working days after delivery to the Administrative Authority of a written request for the hearing.

Hearings concerning the revocation, cancellation or suspension of a stationary engineer's license shall be conducted by the board.

122.1.8 Review of New Materials, Methods And Revisions to the Code. Any person, firm or corporation whose boiler products are not specifically approved by this code may file a petition in writing for approval thereof. The petition shall be delivered to the Administrative Authority, who shall determine whether the material or method should be approved pursuant to Section 105 of this code. If the Administrative Authority denies approval of the material or method, such a decision may be appealed to the board. Any such appeal shall be made in writing and delivered to the secretary of the board. The matter shall be set for hearing before the board.

The board shall receive requests for revisions to those provisions of this Code that affect matters relating to boilers, and it shall be the duty of the board to recommend to the City Council any changes herein that the board deems necessary. The board shall make a report to the City Council annually stating its recommended changes.

122.1.9 Appeals. Any owner, user, license applicant, license holder, or interested person who is affected and aggrieved by a decision of the board may appeal to the City Council, provided that written notice to the City Council of such appeal is delivered to the City Secretary within 10 days after the date of the decision of the board.

Upon appeal to the City Council from the board's decision, the board's secretary shall file with the City Council a copy of the minutes of the board setting forth the board's decision and a copy of any minutes of the board reflecting any discussion or motions concerning the matter. Upon receipt of such materials, the City Council shall set the matter for consideration. All appeals to the City Council are subject to the rules of the City Council, which are codified in Section 2-2 of the City Code and are available from the City Secretary. Parties wishing to preserve their rights of appeal must comply with the rules of City Council.

All orders of decisions of the Administrative Authority shall be in writing and shall be and remain in full force and effect until reversed by the board, the City Council, or suspended, cancelled or annulled.

The decision of the City Council shall be final in all controversies arising under this code.

122.2 License

122.2.1 Stationary Engineer's License. Persons who desire to secure a stationary engineer's license shall apply to the board and pay to the Administrative Authority the fee hereinafter required.

Licenses shall be granted in three grades:

1. A first-grade stationary engineer's license shall entitle the licensee to have direct charge of, operate or supervise any power boiler or boilers of any size.
2. A second-grade stationary engineer's license shall entitle the licensee to have direct charge of, operate, and supervise any power boiler or boilers having an aggregate amount of heat output not to exceed 8,380,000 Btu per hour and to act as assistant or watch engineer under the charge and supervision of the holder of a first-grade stationary engineer's license of any power boiler or boilers.
3. A third-grade stationary engineer's license shall entitle the licensee to have direct charge of, operate, or supervise any power boiler or boilers having an aggregate amount of heat output not to exceed 3,352,000 Btu per hour and

to act as assistant or watch engineer under the charge and supervision of the holder of a first or second-grade stationary engineer's license of any power boiler or boilers having an aggregate amount of heat output not to exceed 8,380,000 Btu per hour.

122.2.2 Stationary Engineer Examination Application. An applicant for a first-grade stationary engineer's license shall present to the board service letters, or certified copies of same, showing that he or she has either the following specified experience or combination of experience and education: (i) at least five years of hands-on boiler operating experience on boilers used to heat water or liquid for environmental heating or commercial processing purposes or for generating steam or vapor by direct application of heat; (ii) a graduation certificate from an accredited engineering school and at least two years of hands on boiler operating experience with boilers used to heat water or liquid for environmental heating or commercial processing purposes or for generating steam or vapor by direct application of heat; or (iii) a United States Department of Labor diploma showing the applicant finished a full three-year course as an apprentice stationary engineer and two years of hands on boiler operating experience with boilers used to heat water or liquid for environmental heating or commercial processing purposes or for generating steam or vapor by direct application of heat.

An applicant for a second-grade stationary engineer's license shall present to the board service letters or certified copies of same, showing that he or she has: (i) at least three years of hands on boiler operating experience with boilers used to heat water or liquid for environmental heating or commercial processing purposes or for generating steam or vapor by direct application of heat; or (ii) a graduation certificate from an accredited engineering school and at least one year of hands on boiler operating experience on boilers used to heat water or liquid for environmental heating or commercial processing purposes or for generating steam or vapor by direct application of heat.

An applicant for a third-grade stationary engineer's license shall present to the board service letters or certified copies of same, showing that he or she has: (i) at least two years of hands on boiler operating experience with boilers used to heat water or liquid for environmental heating or commercial processing purposes or for generating steam or vapor by direct application of heat; or (ii) a graduation certificate from an accredited engineering school and at least six months of hands on boiler operating experience on boilers used to heat water or liquid for environmental heating or commercial processing purposes or for generating steam or vapor by direct application of heat.

No person may take an examination for a stationary engineer's license unless he or she has submitted the service letters, certificates, and/or diplomas to the board as required by this section and the submitted documents have been accepted by the board.

Applicants will be required to correctly answer at least 70 percent of the questions comprising the examination and will be required to attain at least a grade of 70 percent on the examination in order to qualify for a stationary engineer's license of any grade. All questions and answers will be written in the English language.

When an applicant for a stationary engineer's license shall fail to satisfactorily pass an examination, the applicant shall not be entitled to a refund of the examination fee paid to the jurisdiction and shall not be reexamined for the grade in which the applicant failed, or examined for a higher grade, within a period of less than 90 days.

Each applicant shall pay the following examination fee for each and every such examination an applicant applies for:

First-grade stationary engineer.....$25.00

Second-grade stationary engineer.....$25.00

Third-grade stationary engineer.....$25.00

The fee is to be paid to the Administrative Authority at the time the application is filed. All service letters or certified copies thereof presented by anyone taking an examination shall be filed with the application. An applicant shall not be eligible for examination within seven days of the date of application, but shall be examined by the

board on, but not later than, the date of the next regularly scheduled examination thereafter.

Applicants who have successfully passed the examination shall pay a $25.00 license fee to the jurisdiction prior to the issuance of the license. The license shall expire on December 31 of the year of issuance, unless sooner suspended or revoked. Thereafter, the license may be renewed annually pursuant to the provisions set forth below. The receipt for payment of a license renewal fee shall be displayed with the license and failure to do so shall constitute grounds for the suspension or revocation of the license.

122.2.3 License Renewals. License renewals shall be granted without reexamination upon payment of a fee of $25.00, provided such fee is paid within 30 days after the expiration date of the license and not thereafter. When an application for renewal is filed more than 30 days after the expiration of the license, the fee for renewal shall be $35.00 during the first year after the expiration date plus $25.00 for each additional year or part of a year thereafter. When the annual license renewal fee has not been paid for a period of five consecutive years, the license shall not be renewed until the applicant has successfully passed a reexamination.

Each certificate or license issued under the terms and provisions of this section shall be signed as required by the board.

122.2.4 Validity, Replacement of License. When the holder of a license is examined by the board and granted a license in a higher grade, the higher grade license shall not be issued until the license of the lower grade is surrendered and all required fees are paid to the Administrative Authority.

When a license becomes lost or destroyed, the board shall grant a new license in the same grade, provided proof of such loss or destruction is presented to the satisfaction of the board. The fee for replacement license shall be $25.00. If the proof of such loss or destruction is not satisfactory to the board, reexamination in the same

grade shall be required, and the fee for the reexamination shall be as provided in Section 122.2.2.

122.2.5 Reciprocity. A person who holds a current and valid marine engineer's license issued by the United States Coast Guard shall be qualified for examination by the board for a stationary engineer's license of equal or lower grade, provided the license fee set forth in Section 122.2.2 has been paid.

A person who holds a current and valid stationary engineer's or a steam engineer's license issued by a state municipality or government agency shall be qualified for examination by the board in the grade of the equivalent license in this jurisdiction, as determined by the board, provided the holder of the license presents proof to the satisfaction of the board that said license was granted as a result of boiler operating experience and a passing grade on a written examination on the operation, maintenance and repair of boilers and boiler accessories and safety rules for the boilers.

No license issued by a foreign government, graduation certificate from a foreign school, college or university, or any service letter from an employer in a foreign country shall qualify the holder thereof to be examined by the board for a stationary engineer's license of any grade unless the submitted document and the information contained therein are determined valid by the board and equivalent to the standards prescribed above. Upon examination of the evidence of validity presented, the board shall designate the grade in which the applicant may be examined, if such evidence is found by the board to be valid.

122.2.6 Expiation of License. Each license issued for stationary engineers that were in effect immediately preceding the adoption of this code by City Council shall expire on the 31st day of December of the year in which this code is adopted. Any such license may be renewed as though it had been originally issued pursuant to this code.

122.2.7 Limitations of Operator. Except as provided in Section 123, no person shall have the direct charge, control or supervision of, or act as or perform the duties of a stationary engineer, whether on an in charge, assistant watch engineer or other basis, on any power boiler.

Nor shall any owner, user or person operate or use, or cause or permit any boiler to be operated or used unless the persons responsible for the operation of the boiler have current and valid licenses of the applicable classes as required in Section 122.2.1.

122.2.8 Duties of the Certificate Holder. Each holder of a certificate of stationary engineer's license shall file with the board the name of the employer, the plant location, and the aggregated amount of Btu-per-hour heat output of the boiler or boilers that the holder is operating. Each holder of a stationary engineer's license shall enclose his or her license certificate under glass in a dustproof frame and shall display it in a conspicuous place in the plant where the holder is employed.

The operator's permit issued under Section 123 designating the person in charge of the boiler shall be enclosed under glass in a dustproof frame by the certificate holder thereof and prominently displayed in the boiler room as near as convenient to the boiler or boilers to which the operator's permit applies.

122.2.9 Responsibility of the Boiler Owner or User. Every owner or user of a power boiler that has an aggregate heat output that exceeds 1,676,000 Btu per hour shall establish a method of operation utilizing one or more licensed stationary engineers of the herein required license grade(s). The operating method shall include direct physical examination of the boiler by the licensed stationary engineer(s) at reasonable time intervals to ensure its safe operation. The owner or user shall establish the operating method based on accepted boiler industry practices commensurate with load characteristics, use and configuration of the boiler.

123.0 Boiler Operator's Permit

An owner or user of any hot-water-heating boiler or low-pressure hot-water-heating boiler used to heat water or liquid for environmental heating or commercial processing purposes or a power boiler having an aggregate heat output that does not exceed 1,676,000 Btu per hour, may apply to the board for a permit to allow the boiler to be operated by the owner or user or by a person knowledgeable in the operation of the boiler, instead of by a licensed stationary engineer. The person who is to operate the boiler or boilers shall be the owner of the boiler or his or her bona fide employee and shall demonstrate competency to do so in a manner determined by the board. The board shall establish the method of testing and the minimum knowledge, ability, and qualifications such person must demonstrate to show competency to operate the distinctive types of boilers. If a person demonstrates competency in the operation of the type of boiler for which the permit is sought, the permit shall be granted upon the payment of a permit fee of $25.00. The permit shall expire on December 31st of each year, unless sooner suspended or revoked for cause.

Renewal of such permits shall be granted upon the payment of $25.00 if the renewal is applied for within 30 days after the expiration of such permit. If the renewal is not applied for within 30 days, the applicant may renew the permit upon payment of a fee of $30.00.

A permit shall be valid only for the specific location and for the boiler(s) at the location named on the permit. Separate permits may be issued for a person to operate boilers at two or more locations owned by the employer of the boiler operator listed on the permit.

When a permit is issued for boiler operation at two or more locations, the applicant must file for a separate boiler operator permit for each location and pay the fee for each boiler operator permit received.

When an operator's permit becomes lost or destroyed, the board may grant a new permit on the same basis as is set out in Section 122.2.4 for the replacement of a stationary engineer's license.

All permits issued for the operation of boilers in effect immediately preceding the adoption of this code by City Council shall expire on the 31st day of December of the year in which this code is adopted. Any such permit may be renewed as though it had been originally issued pursuant to this code.

124.0 Boiler Related Inspections And Liabilities

The Administrative Authority shall periodically inspect each location where a boiler is installed to determine if the boiler is being operated by an authorized person in accordance with all applicable laws. Such inspections shall be made annually or at such other intervals as the Administrative Authority determines is necessary to ensure compliance with applicable laws.

Exception: Boilers used solely for the production of domestic water.

It is not the intention of these rules and regulations to conflict with or be contradictory to the State of Texas Boiler Law as it appears in Chapter 755 of the Texas Health and Safety Code and any amendments thereto that may be made from time to time.

The provisions of this code shall not be construed to relieve from responsibility or lessen the responsibility of any person, firm, corporation, master plumber or appliance dealer or installer owning, operating or installing any boiler or other equipment described in this section for damages to persons or property, caused by any defect therein, nor shall the jurisdiction be held as assuming by this code any such liability by reason of the inspection authorized herein or the approvals issued as herein provided or otherwise.

TABLE 1-1
Mechanical Permit Fees
Permit Issuance

1. For the issuance of each permit ..... *
2. For issuing each supplemental permit for which the original permit has not expired or been canceled or finaled ..... *

Unit Fee Schedule

Note: the following do not include permit-issuing fees.

1. **Furnaces**

For the installation or relocation of each forced-air or gravity-type furnace or burner, including ducts and vents attached to such appliance, up to and including 100,000 Btu/h (29.3 kW) ..... *
For the installation or relocation of each forced-air or gravity-type furnace or burner, including ducts and vents attached to such appliance over 100,000 Btu/h (29.3 kW) ..... *
For the installation or relocation of each floor furnace, including vent ..... *
For the installation or relocation of each suspended heater, recessed wall heater or floor-mounted unit heater ..... *

2. **Appliance Vents**

For the installation, relocation or replacement of each appliance vent installed and not included in an appliance permit ..... *

3. **Repairs or Additions**

For the repair of, alteration of, or addition to each heating appliance, refrigeration unit, cooling unit, absorption unit, or each heating, cooling, absorption, or evaporative cooling system, including installation of controls regulated by this code ..... *

4. **Boilers, Compressors and Absorption Systems**

For the installation or relocation of each boiler or compressor to and including three (3) horsepower, or each absorption system to and including 100,000 Btu/h (29.3 kW) ..... *
For the installation or relocation of each boiler or compressor over three (3) horsepower (2.24 kW) to and including 15 horsepower (11.19 kW), or each absorption system over 100,000 Btu/h (29.3 kW) and including 500,000 Btu/h (146.48 kW) ..... *
For the installation or relocation of each boiler or compressor over 15 horsepower (11.19 kW) to and including thirty (30) horsepower (22.37 kW), or each absorption system over 500,000 Btu/h (146.48 kW) to and including 1,000,000 Btu/h (29.3 kW) ..... *
For the installation or relocation of each boiler or compressor over thirty (30) horsepower (22.37 kW) to and including fifty (50) horsepower (37.3 kW), or for each absorption system over 1,000,000 Btu/h (292.95 kW) to and including 1,750,000 Btu/h (512.66 kW) ..... *
For the installation or relocation of each boiler or compressor over fifty (50) horsepower (37.3 kW), or each absorption system over 1,750,000 Btu/h (512.66 kW) ..... *

5. **Air Handlers**

For each air-handling unit to and including 10,000 cfm (4.72 m^3/S), including ducts attached thereto ..... *
Note: This fee shall not apply to an air-handling unit which is a portion of a factory-assembled appliance, cooling unit, evaporative cooler or absorption unit for which a permit is required elsewhere in this code.

6. **Evaporative Coolers**

For each air handling unit over 10,000 cfm (4.72 m^3/S) ..... *
For each evaporative cooler other than portable type ..... *

TABLE 1-1 (Continued)
Mechanical Permit Fees

7. **Ventilation and Exhaust**

For each ventilation fan connected to a single duct ..... *
For each ventilation system which is not a portion of any heating or air conditioning system authorized by a permit ..... *
For the installation of each hood which is served by mechanical exhaust, including the ducts for such hood ..... *

8. **Incinerators**

For the installation or relocation of each domestic-type incinerator ..... *

~~For the installation or relocation of each commercial or industrial-type incinerator ..... _____*~~

~~9. **Miscellaneous**~~

~~For each appliance or piece of equipment regulated by this code, but not classed in other appliance categories, or for which no other fee is listed in this table ..... _____*~~

~~10. When Chapter 13 in Appendix B is applicable (see Section 103.0), permit fees for fuel gas piping shall be as follows:~~

~~For each gas piping system of one to five outlets ..... _____*~~

~~For each additional gas piping system, per outlet ..... _____*~~

~~11. Process Piping:~~

~~For each hazardous process piping system (HPP) of one to four outlets ..... _____*~~

~~For each HPP piping system of five or more outlets, per outlet ..... _____*~~

~~For each nonhazardous process piping system (NPP) of one to four outlets ..... _____*~~

~~For each NPP piping system of five or more outlets, per outlet ..... _____*~~

~~**Other Inspections and Fees**~~

~~1. Inspections outside of normal business hours, per hour (minimum charge – two hours) ..... _____*~~

~~2. Reinspection fees assessed under provisions of Section 116.7, per inspection ..... _____*~~

~~3. Inspections for which no fee is specifically indicated, per hour(minimum charge – one-half hour) ..... _____*~~

~~4. Additional plan review required by changes, additions or revisions to plans or to plans for which an initial review has been completed, per hour (minimum charge – one-half hour) ..... _____*~~

~~* Jurisdiction will indicate their fees here.~~

CHAPTER 2

DEFINITIONS

ADMINISTRATIVE AUTHORITY is the ~~individual official, board, department, or agency established and authorized by a state, county, city, or other political subdivision created by law to~~ jurisdiction's Director of the Planning and Development Department, who is appointed to administer and enforce the provisions of this code ~~the mechanical code as adopted or amended~~. This definition shall include the Administrative Authority's duly authorized representatives.

BUILDING OFFICIAL. ~~See ADMINISTRATIVE AUTHORITY.~~ is the person within the jurisdiction's Department of Planning and Development who is primarily responsible for the management of the jurisdiction's building permit office and related functions.

OCCUPANCY CLASSIFICATION. ~~For the purpose of this code, certain occupancies are defined as follows:~~ Classifications shall be as defined in the Building Code.

~~**Group A Occupancies**~~

~~Group A Occupancies include the use of a building or structure, or a portion thereof, for the gathering together of fifty (50) or more persons for purposes such as civic, social or religious functions, recreation, education of instruction, food or drink consumption, or awaiting transportation. A room or space used for assembly purposes by less than fifty (50) persons and accessory to another occupancy shall be included as a part of that major occupancy. Assembly occupancies shall include the following:~~

~~**Division 1.** A building or portion of a building having an assembly room with an occupant load of 1,000 or more and a legitimate stage.~~

~~**Division 2.** A building or portion of a building having an assembly room with an occupant load of less than 1,000 and a legitimate stage.~~

Division 2.1. A building or portion of a building having an assembly room with an occupant load of 300 or more without a legitimate stage, including such buildings used for educational purposes and not classed as a Group B or E Occupancy.

Division 3. A building or portion of a building having an assembly room with an occupant load of less than 300 without a legitimate stage, including such buildings used for educational purposes and not classed as a Group B or E Occupancy.

Division 4. Stadiums, reviewing stands and amusement park structures not included within other Group A Occupancies. Specific and general requirements for grandstands, bleachers and reviewing stands are in the Building Code.

Exception: Amusement buildings, or portions thereof, which are without walls or a roof and constructed to prevent the accumulation of smoke in assembly areas.

Group B Occupancies

Group B Occupancies shall include buildings, structures, or portions thereof, for office, professional or service-type transactions, which are not classified as Group H Occupancies. Such occupancies include occupancies for the storage of records and accounts and eating and drinking establishments with an occupant load of less than fifty (50).

Group E Occupancies

Division 1. Any building used for educational purposes through the 12th grade by fifty (50) or more persons for more than twelve (12) hours per week or four hours in any one day.

Division 2. Any building used for educational purposes through the 12th grade by less than fifty (50) persons for more than twelve (12) hours per week or four hours in any one day.

Division 3. Any building or portion thereof used for day-care purposes for more than six persons.

Group F Occupancies

Group F Occupancies shall include the use of a building or structure, or a portion thereof, for assembling, disassembling, fabricating, finishing, manufacturing, packaging, repair or processing operations that are not classified as Group H Occupancies.

Division 1. Moderate-hazard factory and industrial occupancies shall include factory and industrial uses which are not classified as Group F, Division 2 Occupancies.

Division 2. Low-hazard factory and industrial occupancies shall include facilities producing noncombustible or nonexplosive materials which, during finishing, packing or processing, do not involve a significant fire hazard.

Group H Occupancies

Group H Occupancies shall include buildings or structures, or portions thereof, that involve the manufacturing, processing, generation or storage of materials that constitute a high fire, explosion or health hazard. For definitions, identification and control of hazardous materials and pesticides, and the display of nonflammable solid and nonflammable or noncombustible liquid hazardous materials in Group B, F, M or S Occupancies, see the Fire Code.

Division 1. Occupancies with a quantity of material in the building in excess of those listed in the Building Code, which present a high explosion hazard.

Division 2. Occupancies where combustible dust is manufactured, used or generated in such a manner that concentrations and conditions create a fire or explosion potential. Occupancies with a quantity of material in the building in excess of those listed in the Building Code, which present a moderate explosion hazard or a hazard from accelerated burning.

Division 3. Occupancies where flammable solids, other than combustible dust, are manufactured, used or generated.

Division 4. Repair garages not classified as Group S, Division 3 Occupancies.

Division 5. Aircraft repair hangars and heliports not classified as Group S, Division 5 Occupancies.

Division 6. Semiconductor fabrication facilities and comparable research and development areas in which hazardous production materials (HPM) are used and the aggregate quantity of materials is in excess of those listed in the Building Code.

Division 7. Occupancies having quantities of materials in excess of those listed in the Building Code, which are health hazards.

~~Group I Occupancies~~

~~Division 1.1.~~ ~~Nurseries for the full-time care of children under the age of six (each accommodating more than five children). Hospitals, sanitariums, nursing homes with non-ambulatory patients, and similar buildings (each accommodating more than five patients).~~

~~Division 1.2.~~ ~~Health care centers for ambulatory patients receiving outpatient medical care which may render the patient incapable of unassisted self-preservation (each tenant space accommodating more than five such patients).~~

~~Division 2.~~ ~~Nursing homes for ambulatory patients, homes for children six years of age or over (each accommodating more than five patients or children).~~

~~Division 3.~~ ~~Mental hospitals, mental sanitariums, jails, prisons, reformatories and buildings where personal liberties of inmates are similarly restrained.~~

~~Group M Occupancies~~

~~Group M Occupancies shall include buildings, structures, or portions thereof, used for the display and sale of merchandise, and involving stocks of goods, wares or merchandise, incidental to such purposes and accessible to the public.~~

~~Group R Occupancies~~

~~Division 1.~~ ~~Hotels and apartment houses. Congregate residences (each accommodating more than ten (10) persons).~~

~~Division 2.~~ ~~Not used.~~

~~Division 3.~~ ~~Dwellings and lodging houses. Congregate residences (each accommodating ten (10) persons or less).~~

~~Group S Occupancies~~

~~Group S Occupancies shall include the use of a building or structure, or a portion thereof, for storage not classified as a hazardous occupancy.~~

~~Division 1.~~ ~~Moderate hazard storage occupancies shall include buildings or portions of buildings used for storage of combustible materials that are not classified as Group S, Division 2 or Group H Occupancies.~~

~~Division 2.~~ ~~Low-hazard storage occupancies shall include buildings, structures, or portions thereof, used for storage of noncombustible materials such as products on~~

~~wood pallets or in paper cartons with or without single-thickness divisions, or in paper wrappings, and shall include ice plants, power plants and pumping plants.~~

~~**Division 3.** Division 3 Occupancies shall include repair garages where work is limited to exchange of parts and maintenance requiring no open flame or welding, motor vehicle fuel-dispensing stations, and parking garages not classed as Group S, Division 4 open parking garages or Group U private garages.~~

~~**Division 4.** Open parking garages.~~

~~**Division 5.** Aircraft hangars where work is limited to exchange of parts and maintenance requiring no open flame or welding, and helistops.~~

~~**Group U Occupancies**~~

~~**Division 1.** Private garages, carports, sheds and agricultural buildings.~~

~~**Division 2.** Fences over six feet (1829 mm) high, tanks and towers.~~

RECOGNIZED ENGINEERING PRINCIPLES shall mean principles that are consistent with accepted and sound practices followed by licensed professional engineers within the jurisdiction and approved by the Administrative Authority.

REFRIGERATION CAPACITY RATING is a unit expressed as one horsepower, one ton or 12,000 Btu/h (3.52 kW), each of which shall mean the same quantity.

REFRIGERATION SYSTEM, UNIT is a refrigerating unit not exceeding 3 horsepower rating that has been factory assembled and tested prior to its installation. The unit shall not be connected to any ductwork and shall be a complete one-unit package without remote parts.

SOLDERED JOINT is a joint obtained by the joining of metal parts with metallic mixtures or alloys that melt at a temperature below 800°F (427°C) and above 400°F (204°C).

STOP VALVE is a device to shut off the flow of refrigerant.

***NOTE: All other portions of Sections 203 through 228 remain as set forth in the Uniform Mechanical Code.**

CHAPTER 3

GENERAL REQUIREMENTS

301.0 Scope

This chapter ~~covers~~ contains general requirements for heating, ventilating, air conditioning, refrigeration, miscellaneous heat-producing and energy-utilizing equipment. ~~These equipments~~ Systems and equipment shall conform to the requirements of this code.

Equipment shall not be installed or altered in violation of this code, nor shall the fuel input rate to equipment be increased in excess of the approved Btu/h (kW) rating at the altitude where it is being used.

Defective material or parts shall be replaced in such a manner as ~~not to invalidate any approval~~ to preserve an approval or a listing.

307.2.7 Required clearances from combustible surfaces on which or adjacent to which it may be mounted.

~~Also, the appliance shall be accompanied by clear and complete installation instructions, including required clearances from combustibles other than mounting or adjacent surfaces, and temperature rating of field-installed wiring connections if over 140°F (60°C).~~

307.4 Instructions and Clearances. Also, the appliance shall be accompanied by clear and complete installation instructions, including required clearances from combustibles other than mounting or adjacent surfaces, and temperature rating of field-installed wiring connections if over 60°C.

309.0 Electrical Connections

Equipment regulated by this code requiring electrical connections of more than fifty (50) volts shall have a positive means of disconnect in accordance with the Electrical Code. ~~adjacent to and in sight from the equipment served. A 120-Volt receptacle shall be located~~

~~within twenty-five (25) feet (7620 mm) of the equipment for service and maintenance purposes. The receptacle need not be located on the same level as the equipment~~. Low voltage wiring of fifty (50) volts or less within a structure shall be installed in a manner to prevent physical damage.

310.1 Condensate Disposal. Condensate from air washers, air cooling coils, fuel-burning condensing appliances, the overflow from evaporative coolers and similar water supplied equipment or similar air conditioning equipment shall be collected and discharged to an approved plumbing fixture or disposal area. ~~If discharged into the drainage system equipment shall drain by means of an indirect waste pipe~~. The ~~waste~~ drain pipe shall have a slope of not less than 1/8 inch per foot (10.5 mm/m) or one percent slope and shall be of approved corrosion-resistant material not smaller than the outlet size as required in either Section 310.3 or 310.4 below for air-cooling coils or condensing fuel-burning appliances, respectively. Condensate or waste water shall not drain over a public way.

310.2 Condensate Control. When a cooling coil or cooling unit is located in an attic, ~~or~~ furred space, or where damage may result from condensate overflow, an additional water-tight pan of corrosion resistant metal shall be installed beneath the cooling coil or unit top to catch the overflow condensate due to a clogged primary condensate drain, or one pan with a standing overflow and a separate secondary drain may be provided in lieu of the secondary drain pan. The additional pan or the standing overflow shall be provided with a drain pipe, minimum 3/4 inch (19.1 mm) nominal pipe size, discharging at a point which can be readily observed.

Exception: The additional watertight pan may be of corrosion resistant material other than metal, when approved by the Administrative Authority.

This requirement is in addition to the requirements in Sections 310.3 and 310.4.

310.3 Condensate Waste Sizing. Condensate waste pipes from air-cooling coils shall be sized in accordance with equipment capacity as follows:

Equipment Capacity in Tons of Refrigeration (kW)		Minimum Condensate Pipe Diameter in Inches (mm)	
Up to 10 ~~20~~	(Up to 35.17 ~~70.34~~)	3/4	(20)
Over 10 ~~21~~ – 40	(Over 35.17 ~~73.85~~ – 140.67)	1	(25)
Over 40 ~~41~~ – 90	(Over 140.65 ~~144.19~~ – 316.6)	1-1/4	(32)
Over 90 ~~91~~ – 125	(Over 316.6 ~~320.03~~ – 439.6)	1-1/2	(40)
Over 125 ~~126~~ – 250	(Over 439.6 ~~443.12~~ – 879.2)	2	(50)

The size of condensate waste pipes may be for one unit or a combination of units, or as recommended by the manufacturer. The capacity of waste pipes assumes a 1/8 inch per foot (10.5 mm/m) or one percent slope, with the pipe running three-quarters full. ~~:~~

~~Outside Air – 20%~~		~~Room Air – 80%~~	
~~DB~~	~~WB~~	~~DB~~	~~WB~~
~~90°F (32°C)~~	~~73°F (23°C)~~	~~75°F (24°C)~~	~~62.5°F (17°C)~~

Condensate drain sizing for other slopes or other conditions shall be approved by the Administrative Authority.

310.5 Plastic Fittings. Female PVC screwed fittings shall not be used ~~with plastic male fittings and plastic male threads only~~.

311.0 Personnel Protection

A suitable and substantial metal guard shall be provided around exposed flywheels, fans, pulleys, belts and moving machinery which are within 7-1/2 feet of the nearest adjacent working surface and where such components are portions of a heating, ventilating or refrigerating system.

312.2 Filters for Direct Gas-fired Makeup Air Heaters. Air passing through or over the burners of direct gas-fired makeup air heaters shall be outside air that is screened or filtered to prevent leaves papers or other objects from being picked up from the outside, ignited and discharged into the heated space.

312.3 Filters for Direct Gas-fired Industrial Air Heaters. Gas-fired industrial air heaters employing recirculation shall have filters installed in both the outside air inlet and the recirculating system.

312.4 Filters for Ventilation Systems. Air filters shall be listed units. Liquid adhesive coatings used on filters shall have a flash point of 350°F (177°C) or higher, as determined by ASTM D-93.

CHAPTER 4

VENTILATION AIR SUPPLY

401.0 General

This chapter contains requirements for evaporative cooling systems and makeup air requirements for direct-gas fired heaters, industrial air heaters and miscellaneous heaters. Ventilation air supply requirements for specific occupancies are found in ~~the Building Code~~ Part III of this chapter.

Part III – Ventilation Requirements

407.0 Scope

Buildings and structures enclosing spaces intended for human occupancy shall be provided with ventilation in accordance with this chapter.

408.0 Ventilation

408.1 General. Enclosed portions of buildings and structures in occupancies, other than the locations specified in Sections 408.3 through 408.7, shall be provided with natural ventilation by means of openable exterior openings with an area of not less than 1/20 of the total floor area of the enclosed portion of the building or structure or shall be provided with a mechanically operated ventilating system. The mechanically operated ventilating system shall be capable of supplying ventilation air in accordance with Table 4-1 during such time as the building or space is occupied.

408.2 Applicability. Outside air quantities listed in Table 4-1 are minimum requirements and are not necessarily adequate for all occupancy conditions.

408.3 Toilet Rooms. Toilet rooms shall be provided with a fully openable exterior window at least 3 square feet (0.27 m^2) in area; a vertical duct not less than 100 square inches (0.064 516 m^2) in area for the first toilet facility, with 50 additional square inches (0.032 m^2) for each additional facility; or a mechanically operated exhaust system capable of exhausting 50 cubic feet of air per minute (23.6 L/s) for each water closet or urinal installed in the toilet room. Such systems shall be connected directly to the outside, and the point of discharge shall be at least 3 feet (914 mm) from any openable window.

408.4 Ventilation in Hazardous Locations. Rooms, areas or spaces in which explosive, corrosive, combustible, flammable, or highly toxic dusts, mists, fumes, vapors or gases are or may be emitted due to the processing, use, handling, or storage of materials shall be mechanically ventilated as required by the Fire Code and other provisions of this code.

Emissions generated at work stations shall be confined to the area in which they are generated as specified in the Fire Code and other provisions of this code.

Supply and exhaust openings shall be in accordance with this code. Exhaust air contaminated by highly toxic material shall be treated in accordance with the Fire Code.

408.5 Group B Occupancies. In Groups B, F, M, and S Occupancies, or portions thereof, where Class I, II or III-A liquids are used, sufficient mechanical exhaust shall be provided to produce six air changes per hour. Such mechanical exhaust shall be taken from a point at or near the floor level.

408.6 Group S Parking Garages. In parking garages, other than open parking garages as defined in the Building Code, that are used for storing or handling of automobiles operating under their own power and on loading platforms in bus terminals, ventilation shall be provided at a level sufficient to exhaust a minimum of 0.75 cubic feet per minute (cfm) per square foot (0.354 L/s/m^2) of gross floor area. The Administrative Authority shall approve an alternate ventilation system upon demonstration to the satisfaction of the Administrative Authority that it is designed to exhaust a minimum of 14,000 cfm (6608 L/s) for each operating vehicle and is based on the anticipated instantaneous movement rate of

vehicles, but not less than 2.5 percent of the garage capacity (or one vehicle). Whichever method is used, automatic carbon monoxide-sensing devices may be employed to modulate the ventilation system to maintain a maximum average concentration of carbon monoxide of 50 parts per million during any eight-hour period, with a maximum concentration not greater than 200 parts per million for a period not exceeding one hour.

Exception: In repair garages and motor vehicle fuel-dispensing stations without lubrication pits, in storage garages, and in aircraft hangars, the ventilating system may be omitted when, in the Administrative Authority's opinion, the building is supplied with unobstructed openings to the outer air that are sufficient to provide the necessary ventilation.

Connecting offices, waiting rooms, ticket booths and similar uses shall be supplied with conditioned air under positive pressure.

408.7 Group S Repair Garages. In buildings used for the repair or handling of motor vehicles operating under their own power, mechanical ventilation shall be provided at a level sufficient to exhaust a minimum of 1.0 cfm per square foot (5.1 L/s/m^2) of floor area. Each engine repair stall shall be equipped with an exhaust pipe extension duct, extending to the outside of the building. Ducts over 10 feet (3048 mm) in length shall mechanically exhaust 300 cfm (141.6 L/s). Connecting offices and waiting rooms shall be supplied with conditioned air under positive pressure.

Exception: In repair garages and aircraft hangars, the Administrative Authority shall authorize the omission of such ventilating equipment when, in his or her opinion, the building is supplied with unobstructed openings to the outer air that are well distributed and sufficient in size to provide the necessary ventilation. Doors providing adequate cross ventilation may serve to satisfy this requirement.

408.8 Group R occupancies.

408.8.1 Guest rooms. Each guest room and other habitable room within a dwelling unit or congregate residence shall be provided with natural ventilation by means of

openable exterior openings having an area of not less than 1/20 of the floor area of such room or 5 square feet (0.46 m^2), whichever is greater.

Exception: In lieu of required exterior openings for natural ventilation, a mechanical ventilating system that is capable of providing quantities in accordance with Table 4-1 may be provided.

408.8.2 Bathrooms, etc. Each bathroom, water closet compartment, laundry room, or similar room within a dwelling unit shall be provided with natural ventilation by means of openable exterior openings having an area not less than 1/20 of the floor area of such rooms with a minimum of 1-1/2 square feet (0.14 m^2), whichever is greater.

Exceptions:

1. Laundry rooms in Group R-3 Occupancies or laundry rooms within dwelling units in Group R-2 occupancies.
2. In bathrooms containing a bathtub, shower or combination thereof, laundry rooms, and similar rooms, a mechanical ventilation system connected directly to the outside capable of providing exhaust air quantities in accordance with Table 4-1 may be provided. Such systems shall be connected directly to the outside, and the point of discharge shall be at least 3 feet (914 mm) from any opening that allows air entry into occupied portions of the building.
3. Bathrooms that contain only a water closet, lavatory or combination thereof and similar rooms may be ventilated with an approved mechanical recirculating fan or similar device designed to remove odors from the air.

TABLE 4-1
Outdoor Air Requirements for Ventilation[8]

OCCUPANCY[1]	OUTDOOR VENTILATION AIR (cfm per square foot of area unless noted)[2]
	0.472 for L/s per m^2
Group A Occupancies	
Applications similar to:	
Food and Beverage Service	
Bars, cocktail lounge*	1.00
Cafeteria, fast food*	0.50
Dining rooms*	0.50
Kitchens (cooking)[3]	0.30
Sports and Amusement	
Assembly rooms	0.50[6]
Ballrooms and discos Where smoking is permitted* Where smoking is prohibited	 1.67 0.50
Bowling alleys (seating areas)*	1.67
Conference rooms	0.20
Game rooms*	0.83
Ice arenas	0.10 (playing areas)
Playing floors (gymnasium)	0.30
Spectator areas	0.50[6]
Swimming pools (pool and deck area)	0.50
Theaters	
Auditorium	0.50[6]
Lobbies	0.18
Stages, studios	0.50
Ticket booths	0.25
Transportation	
Platforms	1.00

Waiting rooms	0.20
Group B Occupancies	
Applications similar to:	
Offices	
Bank vaults: Greater than 200 square feet Less than 200 square feet	 0.08 0.00
Conference rooms	0.20
Corridors and utilities	0.05
Duplicating, printing areas	0.20
Locker and dressing rooms	0.20
Office spaces	0.08
Pharmacies	0.10
Photo studios	0.10
Public restrooms (per water closet or urinal)	50 cfm/water closet or urinal[4]
Reception areas	0.20
Smoking lounges	1.00
Telecommunication centers and data entry spaces	0.25
Group E Occupancies	
Applications similar to:	
Education	
Auditoriums	0.50[6]
Classrooms	0.22
Corridors	0.00
Laboratories & Art rooms	0.25
Libraries	0.15
Locker rooms	0.25 exhaust
Music rooms	0.30
Smoking lounges*	1.00
Training shop (wood, metal, and auto training)	0.25

Group F Occupancies	
Applications similar to:	
Dry Cleaners, Laundries	
Coin-operated dry cleaners	0.30
Coin-operated laundries	0.30
Commercial dry cleaners and storage	0.90
Commercial laundries	0.25
Pick-up areas	0.12
Group I Occupancies	
Applications similar to:	
Hospitals, Nursing and Convalescent Homes	
Autopsy rooms	0.50[4]
Medical procedure rooms	0.30
Operating rooms	0.60
Patient rooms	0.25
Physical therapy rooms	0.30
Recovery and ICU rooms	0.30
Correctional facilities	
Cells & Day rooms	.10 cfm/person
Dining halls	.20 cfm/person
Guard stations	0.20
Public restrooms	50 cfm/water closet or urinal[4]
Group M Occupancies	
Applications similar to:	
Stores, Sales Floors and Showroom Floors	
Basement and street levels	0.10
Upper levels	0.10
Dressing rooms	0.10
Malls and arcades	0.10

Shipping and receiving areas	0.10
Smoking lounges*	1.00
Storage rooms	0.10
Warehouse	0.05
Specialty Shops	
Nail Salons	200 CFM/Station + 0.22
Barber shops	0.22
Beauty shops	0.22
Clothiers	0.12
Drug stores	0.10
Fabric stores	0.12
Florists	0.10
Food stores	0.08
Furniture stores	.10
Hardware stores	0.10
Pet shops Animal housing areas Other areas	 1.00 0.10
Reducing salons & Exercise rooms	0.25
Group R Occupancies	
Hotels, motels, resorts, dormitories	
Assembly rooms	0.50 [6]
Bedrooms	30 cfm/room[5]
Conference rooms	0.20
Dormitory sleeping rooms	15 cfm/bed[5]
Living rooms	30 cfm/room[5]
Lobbies	0.15
Private bathrooms (intermittent exhaust)	35 cfm/room[5]
Apartment Houses and Dwellings and Lodging Houses	
Individual Dwelling Units, Lodging Houses	

Bathrooms (intermittent exhaust) or (continuous exhaust)	50 cfm/room[4,5] 20 cfm/room[4,5]
Kitchens (intermittent exhaust) or (continuous exhaust)	100 cfm/room[4,5] 25 cfm/room[4,5]
Living areas	0.30[7]
Group S Occupancies	
Applications similar to:	
Enclosed parking garages	0.75

* Smoking permitted, non smoking rates can be ½ the required rate.

1 Applications may not be unique to a single occupancy group. Where specific use is not listed, judgment as to similarity shall be by the Administrative Authority.
2 Based on net occupiable space. The minimum amount of outdoor air supplied during occupancy shall be permitted to be based on the rate per square foot (m^2) of floor area indicated in Table 4-1 or cubic feet per minute (L/s) per person in accordance with nationally recognized standards. Controls shall be permitted to adjust outdoor air ventilation rates to provide equivalent rates per person under different conditions of occupancy.
3 The sum of the outdoor and transfer air from adjacent spaces shall be sufficient to provide an exhaust rate of not less than 0.50 cubic feet per minute per square foot.
4 Normally supplied by transfer air with local mechanical exhaust with no recirculation.
5 Independent of room size.
6 Where there is fixed seating, use 6 cfm/seat.
7 Air changes per hour, but not less than 15 cubic feet per minute (7.08 L/s) per person. Occupancy shall be based on the number of bedrooms: first bedroom = two persons, each additional bedroom = one person. Air quantities from natural ventilation are considered adequate if operable window option is provided.
8 Conformance to applicable state and federal licensing standards will be acceptable in complying with this code.

CHAPTER 5

EXHAUST SYSTEMS

504.1 Makeup and Exhaust Air Ducts. Environmental air ducts not regulated by other provisions of this code shall comply with this section. Ducts shall be substantially airtight and shall comply with the provisions of Chapter 6. ~~Exhaust ducts shall not extend into or through ducts or plenums~~. Exhaust ducts shall terminate outside the building and shall be equipped with back-draft dampers. Environmental air ducts which have an alternate function as a part of an approved smoke-control system do not require design as Class 1 product-conveying ducts.

504.2 Domestic Range Vents. Ducts used for domestic kitchen range ventilation shall be of metal and shall have smooth interior surfaces. Up draft vents do not require backdraft dampers. Vents shall terminate a minimum of 9 inches above grade.

Exception: Ducts for domestic kitchen downdraft grill-range ventilation installed under a concrete slab floor may be of approved Schedule 40 PVC provided:

1. The under-floor trench in which the duct is installed shall be completely backfilled with sand or gravel.
2. Not more than ~~one (1)~~ six (6) inches ~~(25.4 mm)~~ (152.4 mm) of six (6) inch diameter (152 mm) PVC coupling may protrude above the concrete floor surface.
3. PVC pipe joints shall be solvent cemented to provided an air- and grease-tight duct.
4. The duct shall terminate a minimum of 12 inches above grade outside the building and shall be equipped with a backdraft damper.

504.3.1 Moisture Exhaust Ducts. Moisture exhaust ducts shall terminate on the outside of the building a minimum of 9 inches above grade and shall be equipped with a backdraft damper. Screens shall not be installed at the duct termination. Ducts for exhausting

clothes dryers shall not be connected or installed with sheet metal screws or other fasteners which will obstruct the flow. Clothes dryer moisture exhaust ducts shall not be connected to a gas vent connector, gas vent or chimney. Clothes dryer moisture exhaust ducts shall not extend into or through ducts or plenums.

504.3.2.2 Length Limitation. Unless otherwise permitted or required by the dryer manufacturer's installation instructions and approved by the Administrative Authority, domestic dryer moisture exhaust ducts shall not exceed a total combined horizontal and vertical length ~~of fourteen (14) feet (4263 mm)~~, including two (2) ninety degree (90°) (1.57 rad) elbows , of 25 feet for 4-inch diameter duct, and 40 feet for 5-inch diameter duct. Two (2) feet (610 mm) shall be deducted for each ninety degree (90°) (1.57 rad) elbow in excess of two. For duct lengths in excess of 40 feet, a system designed by a registered professional engineer licensed to practice as such in the State of Texas is required.

~~**504.6 Gypsum Wallboard Ducts.** Bathroom and laundry room exhaust ducts may be of gypsum wallboard subject to the limitations of Section 602.1.~~

505.1 General. A mechanical ventilation or exhaust system shall be installed to control, capture and remove emissions generated from product use or handling when required by the ~~Building~~ Construction Code or Fire Code and when such emissions result in a hazard to life or property. The design of the system shall be such that the emissions are confined to the area in which they are generated by air currents, hoods or enclosures and shall be exhausted by a duct system to a safe location or treated by removing contaminants. Ducts conveying explosives or flammable vapors, fumes or dusts shall extend directly to the exterior of the building without entering other spaces. ~~Exhaust ducts shall not extend into or through ducts and plenums.~~

Exception: Ducts conveying vapor or fumes having flammable constituents less than 25 percent of their lower flammability limit (LFL) may pass through other spaces.

Separate and distinct systems shall be provided for incompatible materials.

Contaminated air shall not be recirculated to occupied areas unless contaminants have been removed. Air contaminated with explosive or flammable vapors, fumes or dusts; flammable or toxic gases, or radioactive material shall not be recirculated.

505.3 Makeup Air. Makeup air shall be provided to replenish air exhausted by the ventilation system. Makeup-air intakes shall be located so as to avoid recirculation of contaminated air. ~~within enclosures.~~

505.4 Hoods and Enclosures. Hoods and enclosures shall be used when contaminants originate in a concentrated area. The design of the hood or enclosure shall be such that air currents created by the exhaust systems will capture the contaminants and transport them directly to the exhaust duct. The volume of air shall be sufficient to dilute explosive or flammable vapors, fumes or dusts as set forth in Section 505.2. Hoods of steel shall have a base metal thickness not less than 0.027 inch (0.69 mm) (22 gage) for Class 1 and Class 5 metal duct systems; 0.033 inch (0.84 mm) (20 gage) for hoods serving a Class 2 duct system; 0.044 inch (1.12 mm) (18 gage) for hoods serving a Class 3 duct system; and 0.068 inch (1.73 mm) (14 gage) for hoods serving a Class 4 duct system.

Approved nonmetallic hoods and duct systems may be used for Class 5 corrosive systems when the corrosive mixture is nonflammable. ~~Metal hoods used with Class 5 duct systems shall be protected with suitable corrosion-resistant material~~. Edges of hoods shall be rounded. The minimum clearance between hoods and combustible construction shall be the clearance required by the duct system.

506.1 Materials. Materials used in product conveying duct systems shall be suitable for the intended use and shall be of metal.

Exceptions:

1. Asbestos-cement, concrete, clay or ceramic materials may be used when it is shown that these materials will be equivalent to metal ducts installed in accordance with this chapter.

2. Ducts serving a Class 5 system may be constructed of approved nonmetallic material when the corrosive characteristics of the material being conveyed make a metal system unsuitable and when the mixture being conveyed is nonflammable.

Approved nonmetallic material shall be either a listed product having a flame-spread index of twenty-five (25) or less and a smoke-developed rating of fifty (50) or less on both inside and outside surfaces without evidence of continued progressive combustion, or shall have a flame-spread index of twenty-five (25) or less and shall be installed with an automatic fire-sprinkler protection system inside the duct.

3. Ducts used in central vacuum-cleaning systems within a dwelling unit may be of PVC pipe. Penetrations of fire walls, floor-ceiling or roof-ceiling assemblies shall comply with the Building Code. Copper or ferrous pipes or conduits extending from within the separation between a garage and dwelling unit to the central vacuuming unit may be used.

Aluminum ducts shall not be used in systems conveying flammable vapors, fumes or explosive dusts, nor in Class 2, 3 or 4 systems. Galvanized steel and aluminum ducts shall not be used when the temperature of the material being conveyed exceeds 400°F (205°C).

~~Metal ducts used in Class 5 systems that are not resistant to the corrosiveness of the product shall be protected with appropriate corrosion-resistant material.~~

506.6 Reserved~~. Fire Protection.~~ ~~Sprinklers or other fire-protection devices shall be installed within ducts having a cross-sectional dimension exceeding ten (10) inches (254 mm) when the duct conveys flammable vapors or fumes. Sprinklers shall be installed at twelve (12) foot (3658 mm) intervals in horizontal ducts and at changes in direction. In vertical runs, sprinklers shall be installed at the top and at alternate floor levels.~~

506.7 Clearances. Ducts conveying flammable or explosive vapors, fumes or dusts shall have a clearance from combustibles of not less than eighteen (18) inches (457 mm). This clearance may be reduced when the combustible construction is protected in accordance with Table 3-2.

Ducts conveying products at temperatures exceeding 125°F (52°C) shall have a clearance to combustible materials not less than the following:
125°F (52°C) to 250°F (121°C)—1 inch (25.4 mm); 251°F (122°C) to 600°F (316°C)—8 inches (203 mm). For temperatures exceeding 600°F (316°C), the clearance shall be not less than required for chimneys in Table ~~8-3~~. 8-4.

506.9 Exhaust Outlets. Outlets for exhausts that exceed 600°F (315°C) shall be in accordance with Table ~~8-3~~ 8-4 .

The termination point for exhaust ducts discharging to the atmosphere shall be not less than the following:

508.4 Duct Enclosure. A grease duct serving a Type I hood which penetrates a ceiling, wall or floor shall be enclosed in a duct enclosure from the point of penetration. A duct may only penetrate exterior walls at locations where unprotected openings are permitted by the Building Code. Duct enclosures shall be constructed as the Building Code requires shaft enclosures to be constructed. Duct enclosures shall be of at least one-hour fire-resistive construction in all buildings and shall be of two-hour fire-resistive construction in Types I and II fire-resistive buildings. The duct enclosure shall be sealed around the duct at the point of penetration and vented to the exterior through weather protected openings. The enclosure shall be separated from the duct by at least three (3) inches (76 mm) and not more than twelve (12) inches (305 mm) and shall serve a single grease exhaust duct system.

Exception: Compliance with the shaft enclosure provisions of this section shall not be required where a duct is continuously covered on all sides from the point at which the duct penetrates a ceiling, wall, or floor to the outlet terminal or to a shaft or other fire-rated enclosure required by the Building Code with a listed and labeled insulating system consisting of materials and methods of construction specifically listed for use with grease ducts. Grease duct insulation systems may not be used in lieu of shaft enclosures required by the Building Code.

508.8 Clearances. Exposed grease duct systems serving a Type I hood shall have a clearance from unprotected combustible construction of at least eighteen (18) inches (457 mm). This clearance may be reduced to not less than three (3) inches (76 mm), provided the combustible construction is protected with material required for one-hour fire-resistive construction.

Exception: When using listed materials, clearances shall be as provided in the manufacturer's installation instructions.

508.9 Exhaust Outlets. Exhaust outlets for grease ducts serving commercial food heat-processing equipment shall extend through the roof unless otherwise approved by the Administrative Authority. Such extension shall be at least ~~two (2) feet~~ 40 inches (~~610~~ 1016 mm) above the roof surface, at least ten (10) feet (3048 mm) from parts of the same or contiguous buildings, adjacent property line or air intake opening into any building, and shall be located at least ten (10) feet (3048 mm) above the adjoining grade level.

Exceptions:

1. Exhaust outlets for grease ducts serving commercial food heat-processing equipment may terminate not less that five (5) feet (1524 mm) from an adjacent building, adjacent property line or air intake opening into a building if the air from the exhaust outlet is discharged away from such locations.
2. Upon approval of the ~~building official~~ Administrative Authority, the exhaust from any hood serving commercial food heat-processing equipment may terminate in a properly engineered air recovery system for recirculation to the room in which the hood is located.

509.1 Where Required. Hoods shall be installed at or above all commercial-type deep fat fryers, broilers, fry grills, steam-jacketed kettles, hot-top ranges, ovens, barbecues, rotisseries, dishwashing machines and similar equipment which produce comparable amounts of steam, smoke, grease or heat in a food-processing establishment. For the purpose of this section, a food-processing establishment shall include any building or portion thereof used of the processing of food, but shall not include a dwelling unit.

Exception: This requirement shall not apply to domestic type cooking equipment located in daycare facilities, churches, employee lunch rooms or similar uses that are no more hazardous than kitchen facilities in an individual dwelling unit.

509.2 Materials and Installation. Types I and II hoods shall be constructed of galvanized steel, stainless steel, copper or other material approved by the Administrative Authority for the use intended.

Type I hoods constructed of galvanized steel shall be at least 0.030 inch (0.76 mm) (No. 22 gage) steel.

Type II hoods shall be constructed of at least 0.024 inch (0.61 mm) (No. 24 gage) steel.

Hoods constructed of copper shall be of copper sheets weighing at least twenty-four (24) ounces per square foot (7.32 kg/m^2). Hoods constructed of stainless steel shall have a minimum thickness of 0.030 inch (0.76 mm).

Hoods shall be secured in place by noncombustible supports.

Joints and seams shall be substantially tight. Solder shall not be used except for sealing a joint or seam on copper hoods.

509.7 Capacity of Hoods. Canopy-type commercial cooking hoods shall exhaust through the hood a minimum quantity of air determined by application of the following formulas:

WHERE:

A = the horizontal surface area of the hood, in square feet (m^2).

P = that part of the perimeter of the hood that is open, in feet (mm).

D = distance in feet (mm) between the lower lip of the hood and the cooking surface.

Q = quantity of air, in cubic feet per minute (L/s).

When cooking equipment is installed back to back and is covered by a common island-type hood, the airflow required may be calculated using the formula for three sides exposed. Type II hood airflow requirements shall be in accordance with the requirements for low-temperature appliance hoods. When all appliances are electric, the airflow required may be reduced to 80 percent of the formula value.

510.2.2 Extent of Protection. The fire extinguishing system used to protect ventilating hoods and ducts and cooking appliances shall be installed to include cooking surfaces, deep-fat fryers, griddles, upright broilers, charbroilers, grease-burning charbroilers, range tops and grills. Protection shall also be provided for the enclosed plenum space within the hood above filters and in exhaust ducts serving the hood.

~~**Exception:** That portion of the fire extinguishing system required for protection of the plenum space within the hood beyond the filter and within the exhaust duct serving the hood may be omitted when approved listed grease extractors are installed.~~

CHAPTER 6

DUCT SYSTEMS

~~**601.2 Sizing Requirements.** Duct systems used with blower type equipment which are portions of a heating, cooling, absorption, evaporative cooling or outdoor air ventilation system shall be sized in accordance with Chapter 16, Part II Referenced Standards or by other approved methods.~~

602.1 General. Supply air, return air and outside air for heating, cooling or evaporative cooling systems shall be conducted through duct systems constructed of metal as set forth in Tables 6-1, 6-2 and 6-3 or metal ducts complying with U.M.C. Standard No. 6-2 or the referenced HVAC Duct Construction Standard in Chapter 16, Part II with prior approval. Ducts, plenums and fittings may be constructed of ~~asbestos cement,~~ concrete, clay or ceramics when installed in the ground or in a concrete slab, provided the joints are tightly sealed.

Corridors shall not be used to convey air to or from rooms if the corridor is required to be of fire-resistive construction per the Building Code.

Concealed building spaces or independent construction within buildings may be used as ducts or plenums.

When gypsum products are exposed in ducts or plenums, the air temperature shall be restricted to a range from 50°F (10°C) to 125°F (52°C) and moisture content shall be controlled so that the material is not adversely affected. For the purpose of this section, gypsum products shall not be exposed in ducts serving as supply from evaporative coolers, and in other air-handling systems regulated by this chapter when the temperature of the gypsum product will be below the dew point temperature.

See Chapter 8 for limitations on combustion products venting systems extending into or through ducts. ~~or plenums~~.

See Chapter 5 for limitations on environmental air systems exhaust ducts extending into or through ducts. ~~or plenums~~.

Exhaust ducts under positive pressure and venting systems shall not extend into or pass through ducts. ~~or plenums~~. For appliance vents and chimneys, see Chapter 8.

602.2 Combustibles within Ducts or Plenums. Materials exposed within ducts or plenums shall have a flame-spread index of not more than 25 and a smoke-developed rating of not more than 50 when tested in accordance with the test for surface burning characteristics of building materials. (See the building code standards based on ASTM E-84-91 and ANSI/UL 723-86.)

Exceptions:

1. Return-air and outside-air ducts, plenums or concealed spaces which serve a dwelling unit may be of combustible construction.
2. Air filters meeting the requirements of Sections 312.0 and 503.3.
3. Water evaporation media in an evaporative cooler.
4. Charcoal filters when protected with an approved fire suppression system.
5. Electrical wiring in plenums shall comply with the Electrical Code. Flame propagation and smoke production characteristics of exposed electric cables installed in concealed space used as air plenums <u>except in computer rooms</u> shall:
   A. Exhibit a flame travel of five (5) feet (1524 mm) or less, and
   B. Produce smoke having an average optical density not greater than 0.15 and having a peak optical density of 0.5 or less when tested in accordance with U.M.C. Standard No. 6-3.
   C. Wiring meeting these requirements shall be listed and labeled as plenum cable as required by the Electrical Code.
6. Nonmetallic fire sprinkler piping in plenums shall be listed and shall meet the following requirements:
   A. Exhibit flame travel of five (5) feet (1524 mm) or less, and
   B. Produce smoke having an average optical density not greater than 0.15 and having a peak optical density of 0.5 or less when tested in accordance with U.M.C. Standard No. 6-3.

602.4 Joints and Seams of Ducts. Joints of duct systems shall be made substantially airtight by means of tapes, mastics, gasketing or other means. Sealant materials and methods of assemblage shall be in accordance with the manufacturer's instructions and conform to SMACNA Method A.

Crimp joints for residential round ducts shall have a contact lap of at least 1-1/2 inch (38 mm) and shall be mechanically fastened by means of at least three sheet-metal screws equally spaced around the joint, or an equivalent fastening method.

Joints and seams for 0.016 inch (0.41 mm) (No. 28 gage) and 0.013 inch (0.33 mm) (No. 30 gage) residential rectangular ducts shall be as specified in Table 6-1 for 0.019 inch (0.48 mm) (No. 26 gage) material.

Joints and seams for rectangular duct systems shall be as specified in Table 6-1.

Joints and seams for flat oval ducts and round ducts in other than single dwelling units shall be as specified in Table 6-2.

Joints and seams and all reinforcements for factory-made air ducts and plenums shall meet with the conditions of prior approval in accordance with the installation instructions that shall accompany the product. Closure systems for rigid Class 1 air ducts and plenums, and flexible Class 1 air ducts shall conform to the referenced standards for air ducts in closure systems in Chapter 16, Part II.

602.5 Metal. Every duct, plenum or fitting of metal shall comply with Table 6-1 or 6-2.

Exceptions:

1. Ducts, plenums and fittings for systems serving single dwelling units may comply with Table 6-3.
2. Duct systems complying with U.M.C. Standard No. 6-1.
3. Duct systems complying the U.M.C. Standard 6-2 or the referenced HVAC Duct Construction Standard in Chapter 16, Part II ~~with prior approval~~.

~~**604.1.4** Ducts shall be braced and guyed to prevent lateral or horizontal swing.~~

605.0 Insulation of Ducts

Supply- and return-air ducts and plenums of a heating or cooling system shall be insulated to achieve the minimum thermal (R) value as set forth in Table 6-4, except for ducts and plenums used exclusively for evaporative cooling systems.

Approved materials shall be installed within ducts and plenums for insulating, sound deadening or other purposes. Materials shall have a mold-, humidity- and erosion-resistant surface that meets the requirements of the referenced standard for air ducts in Chapter 16, Part II. Duct liners in systems ~~operating with air velocities~~ exceeding 18 inches ~~2000 feet per minute (10.16 m/s)~~ shall be fastened with both adhesive and mechanical fasteners, and exposed edges shall have adequate treatment to withstand the operating velocity.

Insulation applied to the exterior surface of ducts located in buildings shall have a flame spread of not more than 25 and a smoke-density not exceeding 50 when tested as a composite installation, including insulation, facing materials, tapes and adhesives as normally applied.

Factory-made air ducts and faced insulations intended for installation on the exterior of ducts shall be legibly printed with the name of the manufacturer, the thermal resistance (R) value at installed thickness and the flame-spread and smoke developed ratings of the composite material.

Insulation on ducts in unconditioned spaces shall be vapor sealed.

606.2 Fire Dampers. Fire dampers shall comply with the standard for fire dampers referenced in Chapter 16, Part II, and shall be installed in accordance with approved manufacturer's installation instructions when required by the Building Code. Fire dampers shall have been tested for closure under airflow conditions and shall be labeled for both maximum airflow permitted and direction of flow. When more than one damper is installed at a point in a single air path, the entire airflow shall be assumed to be passing through the smallest damper area. Fire dampers shall be labeled by an approved agency. Only fire dampers labeled for use in dynamic systems shall be installed in heating, ventilation, and air conditioning systems which are intended to operate with fans "on" during a fire.

Ductwork shall be connected to damper sleeves or assemblies in such a way that collapse of the ductwork will not dislodge the damper or impair its proper operation.

606.5 Access and Identification. Dampers shall be provided with an approved means of access, large enough to permit inspection and maintenance of the damper and its operating parts. The access shall not impair fire-resistive construction. Access shall not require the use of tools, keys or special knowledge. Access points shall be permanently identified on the exterior of the duct by a label with letters not less than ½ inch (12.7 mm) in height reading: SMOKE DAMPER or FIRE DAMPER. Access doors in ducts shall be tight fitting and suitable for the required duct construction.

609.0 Automatic Shutoffs

Air-moving systems supplying air in excess of ~~2000~~ 2200 cubic feet per minute (944 L/s) to enclosed spaces within buildings shall be equipped with an automatic shutoff. Automatic shutoff shall be accomplished by interrupting the power source of the air-moving equipment upon detection of smoke in the main supply-air duct or return air duct served by such equipment. Smoke detectors shall be labeled by an approved agency for air-duct installation and shall be installed in accordance with the manufacturer's approved instructions. Such devices shall be compatible with the operating velocities, pressures, temperatures and humidities of the system. Where fire detection or alarm systems are provided for the building, the smoke detectors required by this section shall be supervised by such systems.

Exceptions:

1. When the space supplied by the air-moving equipment is served by a total coverage smoke detection system complying with the Fire Code, interconnection to such system may be used to accomplish the required shutoff.
2. Automatic shutoff is not required when all occupied rooms served by the air-handling equipment have direct exit to the exterior and the travel distance does not exceed 100 feet (30480 mm). For the purpose of this exception, occupied rooms shall not include rooms that have less than 300 square feet and are ancillary to the function of the space served by the air-handling system, such as restrooms, storerooms, or cashier or manager offices.
3. Automatic shutoff is not required for Group R, Division 3 and Group U Occupancies.

4. Automatic shutoff is not required for approved smoke-control systems or where analysis demonstrates shutoff would create a greater hazard, such as may be encountered in air-moving equipment supplying specialized portions of Group H Occupancies. Such equipment shall be required to have smoke detection with remote indication and manual shutoff capability at an approved location.

610.1 Materials. Materials used in product conveying duct systems shall be suitable for the intended use and shall be of metal.

Exceptions:

1. ~~Asbestos cement,~~ Concrete, clay or ceramic materials may be used when it is shown that these materials will be equivalent to metal ducts installed in accordance with this chapter.
2. Ducts serving a Class 5 system may be constructed of approved nonmetallic material when the corrosive characteristics of the material being conveyed make a metal system unsuitable and when the mixture being conveyed is nonflammable.

   Approved nonmetallic material shall be either a listed product having a flame-spread index of 25 or less and a smoke-developed rating of 50 or less on both inside and outside surfaces without evidence of continued progressive combustion, or shall have a flame-spread index of 25 or less and shall be installed with an automatic fire-sprinkler protection system inside the duct.
3. Ducts used in central vacuum-cleaning systems within a dwelling unit may be of PVC pipe. Penetrations of fire walls, floor-ceiling or roof-ceiling assemblies shall comply with the Building Code. Copper or ferrous pipes or conduits extending from within the separation between a garage and dwelling unit to the central vacuuming unit may be used.

Aluminum ducts shall not be used in systems conveying flammable vapors, fumes or explosive dusts, nor in Class 2, 3 or 4 systems. Galvanized steel and aluminum ducts shall not be used when the temperature of the material being conveyed exceeds 400°F (205°C).

Metal ducts used in Class 5 systems that are not resistant to the corrosiveness of the product shall be protected with appropriate corrosion-resistant material.

610.6 Reserved. ~~Fire Protection.~~ ~~Sprinklers or other fire protection devices shall be installed within ducts having a cross-sectional dimension exceeding ten (10) inches (254 mm) when the duct conveys flammable vapors or fumes. Sprinklers shall be installed at twelve (12) foot (3658 mm) intervals in horizontal ducts and at changes in direction. In vertical runs, sprinklers shall be installed at the top and at alternate floor levels.~~

TABLE 6-4
Insulation of Ducts

DUCT LOCATION	INSULATION TYPES MECHANICALLY COOLED AND OUTSIDE AIR	HEATING ZONE[1]	INSULATION TYPES HEATING ONLY
On roof on exterior of building	C, V[2] and W	I II III	A and W B and W C and W
Attics, garages and crawl spaces	A and V[2]	I II III	A A B
In walls,[3] within floor-ceiling spaces[3]	A and V[2]	I II III	A A B
Within the conditioned space or in basements; return ducts in air plenums	None required		None required
Cement slab or within ground	None required		None required

Note: Where ducts are used for both heating and cooling, the minimum insulation shall be as required for the most restrictive condition.

1 Heating Degree Days:
Zone I below 4500 D.D.
Zone II 4501 to 8000 D.D.
Zone III over 8001 D.D.

2 Vapor retarders shall be installed on supply ducts in spaces vented to the outside in geographic areas where the average summer dew point temperature based on the 2-1/2 percent column of dry-bulb and mean coincident wet-bulb temperature exceeds 60°F (16°C).

~~3 Insulation may be omitted on that portion of a duct which is located within a wall- or a floor-ceiling space where:~~

~~a. Both sides of the space are exposed to conditioned air.~~
~~b. The space is not ventilated.~~
~~c. The space is not used as a return plenum.~~
~~d. The space is not exposed to unconditioned air.~~
~~Ceilings which form plenums need not be insulated.~~

INSULATION TYPES[4]:

A. A material with an installed conductance of 0.48 [2.72 W/(m•K)] or the equivalent thermal resistance of ~~2.1 [0.367(m•K)/W]~~ R-5.6.

~~Example of materials capable of meeting the above requirements:~~
~~1 inch (25.4 mm), 0.60 lb./cu. ft. (9.6 kg/m³) mineral fiber, rock, slag or glass blankets.~~
~~½ inch (12.7 mm), 1.5 to 3 lb./cu. ft. (24 to 48. kg/m³). mineral fiber blanket duct liner.~~
~~½ inch (12.7 mm), 3 to 10 lb./cu. ft. (48 to 160 kg/m³) mineral fiber board.~~

B. A material with an installed conductance of 0.24 [1.36 W/(m•K)] or the equivalent thermal resistance of ~~4.2 [0.735(m•K)/W]~~ R-5.6.

~~Example of materials meeting the above requirements:~~
~~2 inch (51 mm), 0.60 lb./cu. ft. (9.6 kg/m³) mineral fiber blankets.~~
~~1 inch (25.4 mm), 1.5 to 3 lb./cu. ft. (24 to 48 kg/m³) mineral fiber blanket duct liner.~~
~~1 inch (25.4 mm), 3 to 10 lb./cu. ft. (48 to 160 kg/m³) mineral fiber board.~~

C. A material with an installed conductance of 0.16 [0.9 W/(m•K)] or the equivalent thermal resistance of ~~6.3 [1.1(m•K)/W]~~ R-8.

~~Examples of materials meeting the above requirements:~~
~~3 inch (76 mm), 0.60 lb./cu. ft. (9.6 kg/m³) mineral fiber blankets.~~
~~1 ½ inch (32 mm), 1.5 to 3 lb./cu. ft. (24 to 48 kg/m³) mineral fiber blanket duct liner.~~
~~1 ½ inch (32 mm), 3 to 10 lb./cu. ft. (48 to 160 kg/m³) mineral fiber board.~~

V. Vapor Retarders: Material with a perm rating not exceeding 0.5 perm (29 ng/Pa•s•m²). All joints to be sealed.

W. Approved weatherproof barrier.

~~4 The example of materials listed under each type is not meant to limit other available thickness and density combinations with the equivalent installed conductance or resistance based on the insulation only.~~

CHAPTER 7

COMBUSTION AIR

707.2 Designed Installations. ~~In lieu of the requirements of Table 7-1, combustion air supply may be designed in accordance with recognized engineering principles when first approved by the Administrative Authority~~. Compliance with Table 7-1 is not required for an installation that has been professionally designed to ensure an adequate supply of combustion air.

TABLE 7-1
Size of Combustion-Air Openings for Ducts[1]

COLUMN 1 **Buildings of Ordinary Tightness**		**COLUMN 2** **Buildings of Unusually Tight Construction[2]**	
CONDITION	SIZE OF OPENINGS OR DUCTS	CONDITION	SIZE OF OPENINGS OR DUCTS
Appliance in unconfined[2] space:	May rely on infiltration alone.	**Appliance in unconfined[2] space:** Obtain combustion air from outdoors or from space freely communicating with outdoors.	Provide two openings, each having 1 sq. in. (645 mm²) per 5000 Btu/h (1.47 kW) input. Ducts admitting outdoor air may be connected to the cold-air return.
Appliance in confined[4] space: 1. All air from inside building.	Provide 2 openings into enclosure, each having 1 sq. in. (645 mm²) per 1000 Btu/h (293 W) input freely communicating with other unconfined interior spaces. Minimum 100 sq. in. (0.06 m²) each opening.[3]	**Appliance in confined[4] space:** Obtain combustion air from outdoors or from space freely communicating with outdoors.	1. Provide two vertical ducts or plenums; 1 sq. in. (645 mm²) per 4000 Btu/h input each duct or plenum. 2. Provide 2 horizontal ducts or plenums; 1 sq. in. (645 mm²) per 2,000 Btu/h input each duct or plenum.

2. Part of air from inside building.	Provide 2 openings into the enclosure[3] from other freely communicating unconfined[2] interior spaces, each having an area of 100 sq. in. (0.06 m²), plus 1 duct or plenum opening to outdoors, having an area of 1 sq. in. Per (645 mm²) 5000 Btu/h (1.47 kW) input rating. The outdoor duct or plenum opening may be connected to the cold-air return.		3. Provide 2 openings in an exterior wall of the enclosure; each opening 1 sq. in. (645 mm²) per 4,000 Btu/h (1.17 kW) input. 4. Provide 1 ceiling opening to ventilated attic and 1 vertical duct to attic; each opening 1 sq. in. (645 mm²) per 4000 Btu/h (1.17 kW) input. 5. Provide 1 opening in enclosure ceiling to ventilated attic and 1 opening enclosure floor to ventilated crawl space; each opening 1 sq. in. (645 mm²) per 4000 Btu/h (1.17 kW) input. <u>6. Provide 1 opening or 1 vertical duct or 1 horizontal duct in the enclosure; 1 sq. in. Per 3,000 Btu/h input</u>
3. All air from outdoors. Obtain from outdoors or from space freely communicating with outdoors.	Use any of the methods listed for confined space in unusually tight construction as indicated in Column II.		

1. For location of openings, see Section 702.0.
2. As defined in Section 223.0.
3. When the total input rating of appliances in enclosure exceeds 100,000 Btu/h (29.3 kW), the area of each opening into the enclosure shall be increased 1 square inch (645 mm²) for each 1,000 Btu/h (293 W) over 100,000 (29.3 kW).
4. As defined in Section 205.0.

CHAPTER 8

CHIMNEY AND VENTS

814.5.1 Metal Chimneys for Residential-Type Incinerators. ~~Galvanized steel pipe not less than 0.129 inch (3.28 mm) (No. 10 galvanized sheet gage number) or other equivalent noncombustible, fire- and corrosion-resistant material may be used for residential-type incinerators installed in locations such as open sheds, breezeways or carports, provided the pipe is exposed and readily examinable for its full length and clearance not less than eighteen (18) inches (457 mm) is maintained from combustible material. The pipe shall extend at least three (3) feet (914 mm) above the highest point where it passes by or through a roof and at least two (2) feet (610 mm) higher than any portion of a building within ten (10) feet (3048 mm). If the pipe passes through a roof constructed of combustible material, it shall be guarded by a ventilating thimble of galvanized sheet steel or approved corrosion-resistant noncombustible material extending not less than nine (9) inches (229 mm) below and nine (9) inches (229 mm) above the roof construction and of a size to provide not less than six (6) inch (152 mm) clearance on all sides of the pipe; or the combustible material in the roof construction shall be cut away so as to provide not less than eighteen (18) inch (457 mm) clearance on all sides of the pipe, with any material used to close up such opening entirely noncombustible.~~

Metal chimneys for residential-type incinerators shall meet the same requirements as metal chimneys for commercial and industrial type incinerators.

815.2.1.2 Residential and Low-Heat Appliances. If serving residential building-heating appliances and low-heat appliances, chimney connectors made of single-wall steel pipe shall be of at least the thickness indicated.

Minimum Diameter of Connector	Thickness	Galvanized Sheet

Inches	(mm)	Inches	(mm)	Gage No.
5 or less	(127 or less)	~~0.013~~ 0.016	~~0.33~~ 0.40	28
Over 5 to 9	(Over 127 to 228)	0.019	0.48	26
Over 9 to 12	(Over 229 to 305)	0.030	0.76	22
Over 12 to 16	(Over 305 to 406)	0.036	0.91	20
Over 16	(Over 406)	0.058	1.47	16

Breeching for medium-heat and high-heat appliances shall be fabricated of black hot-rolled steel with welded seams and shall be of at least the following thickness:

Minimum Diameter of Connector		Thickness		Galvanized Sheet
Inches	(mm)	Inches	(mm)	Gage No.
12 or less	(305 or less)	0.044	1.12	18
Over 12 to 24	(Over 305 to 610)	0.055	1.40	16
Over 24 to 36	(Over 601 to 914)	0.068	1.73	14
Over 36 to 60	(Over 915 to 1524)	0.097	2.46	12
Over 60	(over 1524)	0.127	3.23	10

End joints of breechings may be welded, lapped, bolted or made with companion end flanges. Long breechings shall be provided with expansion joints.

CHAPTER 9

SPECIAL FUEL-BURNING AND ENERGY-UTILIZING EQUIPMENT

906.3 Area Requirements. The minimum unobstructed total area of the outside or return-air ducts or openings to a gravity-type warm-air furnace shall be not less than seven (7) square inches (4516 mm^2) per 1000 Btu/h (293 W) approved output rating or as indicated by the conditions of listing of the furnace.

The minimum unobstructed total area of the outside or return-air ducts or openings to a blower-type warm-air furnace shall be not less than two (2) square inches (1290 mm^2) per 1000 Btu/h (293 W) approved output rating or bonnet capacity of the furnace.

The total area of the outside or return-air ducts indicated by the conditions of listing of the furnace.

The minimum unobstructed total area of the outside or return-air ducts or openings to a heat pump shall be not less than six (6) square inches (3871 mm^2) per 1000 Btu/h (293 W) nominal output rating or as indicated by the conditions of listing of the heat pump.

~~**Exceptions:** Complete duct systems for blower type warm-air furnaces or heat pumps that are sized in accordance with Chapter 16, Part II Referenced Standards or by other approved methods.~~

907.1 Duct Size. The minimum unobstructed total area of the supply-air ducts from a blower-type warm-air furnace shall be not less than two (2) square inches (1290 mm^2) per 1000 Btu/h (293 W) approved output rating of the furnace, and the minimum unobstructed total area of the supply-air ducts from a gravity-type warm-air furnace shall be not less than seven (7) square inches (4516 mm^2) per 1000 Btu/h (293 W) approved output rating or as specified by the conditions of listing of the furnace. The total area of the supply-air ducts need not exceed the area of the furnace outlet plenum collar.

For the purpose of this section, a volume damper, grille or register installed to control airflow shall not be considered an obstruction.

The minimum unobstructed total area of the supply-air ducts from a heat pump shall be not less than six (6) square inches (3871 mm^2) per 1000 Btu/h (293 W) nominal output rating or as indicated by the conditions of the listing of the heat pump.

~~**Exceptions:** Complete duct systems for blower type warm-air furnaces or heat pumps that are sized in accordance with Chapter 16, Part II Referenced Standards or other approved methods.~~

908.0 Attic Furnaces (Upright and Horizontal). Upright furnaces may be installed in an attic or furred space more than five (5) feet (1524 mm) in height, provided the required listings and furnace and duct clearances are observed. Horizontal furnaces may be installed in an attic or furred space provided the required listings and furnace and duct clearances are observed.

Clearances of a warm-air attic furnace from combustibles shall be as specified in Section 304.1.

An attic or furred space in which a warm-air furnace is installed shall be ~~accessible by an opening~~ provided with a pull down stairway with a clear opening not less than 22 inches in width and a load capacity of not less than 350 pounds and an unobstructed passageway as large as the largest piece of the furnace and in no case less than thirty (30) inches by thirty (30) inches (762 mm x 762 mm) continuous from the opening to the furnace and its controls.

~~**Exception:** The access opening into the space may be twenty-two (22) inches by thirty (30) inches (559 mm x 762 mm), provided the largest piece of equipment can be removed through the opening.~~

The distance from the passageway access to furnace shall not exceed twenty (20) feet (6096 mm) measured along the center line of the passageway. The passageway shall be unobstructed and shall have continuous solid flooring not less than twenty four (24) inches (610 mm) wide from the entrance opening to the furnace.

A level working platform not less than thirty (30) inches (762 mm) in depth and width shall be provided in front of the entire firebox side of the warm-air furnace, and if the

furnace temperature-limit control, air filter, fuel-control valve, vent collar or air-handling unit is not serviceable from the firebox side of the furnace, a continuous floor not less than twenty-four (24) inches (610 mm) in width shall be provided from the platform in front of the firebox side of the furnace to and in front of this equipment.

Exception: A working platform need not be provided when the furnace can be serviced from the required access opening.

A permanent electric outlet and lighting fixture controlled by a switch located at the required passageway opening shall be provided at or near the furnace.

910.5 Platform. A furnace located on a roof shall be installed on a substantial level platform. When the roof has a slope greater than four (4 1) in twelve (12), a level working platform at least thirty (30) inches (762 mm) in depth and width shall be provided along the firebox and control sides of the furnace. Sides of a working platform facing the roof edge below shall be protected by a substantial railing forty-two (42) inches (1067 mm) in height with vertical rails not more than twenty-one (21) inches (533 mm) apart, except that parapets at least twenty-four (24) inches (610 mm) in height may be utilized in lieu of rails or guards.

910.6 Catwalk. On roofs having slopes greater than four (4 1) in twelve (12), a catwalk at least twenty-four (24) inches (610 mm) in width with substantial cleats spaced not more than sixteen (16) inches (406 mm) apart shall be provided from the roof access to the working platform at the appliance.

910.8 Access. Every furnace installed in or on an exterior wall of a building, which is designed so that the burners or controls must be serviced from outside the building, shall be readily accessible.

Furnaces located on the roof of a building exceeding 14 feet shall be readily accessible.

Exceptions:

1. Permanent exterior ladders providing roof access need not extend closer than eight (8) feet (2438 mm) to the finish grade.

2. A portable ladder may be used for access for furnaces on the single-story portion of a Group R or U Occupancy.
3. Permanent ladders for equipment access need not be provided at parapets or walls less than thirty (30) inches (762 mm) in height.

Permanent ladders providing roof access shall:

911.5 In ~~Group H, Division 4 Occupancies~~ repair garages, devices generating a spark or glow capable of igniting gasoline vapors shall not be installed or used within eighteen (18) inches (457 mm) of the floor.

911.6 In ~~a Group H, Division 5 Occupancy and Group , Division 5 Occupancy~~ air craft hangars, unless the appliance is located at least eight (8) feet (2438 mm) above the floor.

Overhead heaters installed in aircraft storage or servicing areas ~~of Group S, Division 5 Occupancies~~ shall be at least ten (10) feet (3048 mm) above the upper surface of wings or engine enclosures of the tallest aircraft which may be housed in the hangar. Overhead heaters shall be at least eight (8) feet (2438 mm) above the floor of shops, offices and other sections of hangars communicating with aircraft storage or working areas.

Vented decorative appliances, floor furnaces, vented wall furnaces, unit heaters and room heaters shall be installed so as to minimize the probability of damage from an external source.

915.6 Unit Heaters Installed in ~~Group S Occupancies~~ Motor Vehicle Garages or Air Craft Hangars. Unit heaters installed in motor vehicle garages or air craft hangars ~~Group S, Division 3, 4 or 5 Occupancies~~ shall obtain return air more than four (4) feet (1219 mm) above the floor.

916.2 Vented Overhead. Vented overhead room heaters shall be safely and securely supported with hangers and brackets of noncombustible material and shall be installed with clearances from combustible material as specified on the required manufacturer's label.

Exception: Installation of overhead heaters in aircraft storage or servicing areas of ~~Group S, Division 5 Occupancies~~ air craft hangars shall comply with requirements of Section 911.0.

916.3 Unvented. Unvented fuel-burning room heaters and decorative appliances shall ~~not~~ be prohibited. ~~installed, used, maintained or permitted to exist in a Group I or R Occupancy, nor shall an unvented heater be installed in any building, whether as a new or as a replacement installation, unless permitted by this section. This subsection shall not apply to portable oil-fired unvented heating appliances used as supplemental heating in Group S, Divisions 3, 4 and 5 and Group U Occupancies, and regulated by the Fire Code.~~

916.4 Overhead Radiant Heaters. Listed or approved unvented overhead room heaters may be installed in Group A, ~~Division 2, 2.1, 3 or 4;~~ Group B, Group F, ~~Group H, Division 4; Group H, Division 5,~~ Group M, Group S, or Group U Occupancy, provided the installation conforms to all of the following requirements:

917.0 Domestic Ranges

917.1 Vertical Clearance above Cooking Top. Domestic freestanding or built-in ranges shall have a vertical clearance above the cooking top of not less than thirty (30) inches (762 mm) to unprotected combustible material. When the underside of such combustible material is protected with insulating millboard at least 1/4 inch thick (6.4 mm) covered with ~~0.021~~ 0.016 inch-thick (~~0.53~~ 0.40 mm) (No. 28 U.S. metal gage) or a metal ventilating hood, the distance shall be not less than twenty-four (24) inches (610 mm). For ducts serving domestic range hoods, see Section 504.2.

918.0 Domestic Open-Top Broiler Units

Listed open-top broiler units and hoods shall be installed in accordance with their listing and the manufacturer's installation instructions.

An exhaust duct and fan having a minimum capacity of 100 cfm per square foot (508 L/s/m^2) of hood intake area shall be installed for a barbecue unit and, when the duct penetrates a ceiling or a floor, it shall be enclosed in a fire-resistive shaft covered on one side as required for a one-hour fire resistive construction with no combustible material used inside the fire protection. The shaft shall be separated from the duct by a minimum one (1) inch (25.4 mm) air space vented to the outside air, and the duct shall terminate not less than eighteen (18) inches (457 mm) above the roof surface. A minimum clearance of twenty-four (24) inches (610 mm) shall be maintained between the cooking top and the combustible material and the hood shall be as wide as the open-top broiler and be centered over the unit.

919.2 Relief Openings. The design of the installation shall include adequate provision to permit the equipment to operate at rated capacity ~~by taking into account the structures designed infiltration rate,~~ providing properly designed relief openings, or an interlocked power exhaust system, or a combination of these methods.

Relief openings may be louvers or counterbalanced gravity dampers or, if motorized dampers, shall be interlocked so as not to permit equipment blower and main burner operation until they are proved in the open position.

919.3 Reserved~~. Approval.~~ ~~Each appliance shall be approved by the Administrative Authority for safe use or comply with applicable nationally recognized standards as determined by an approved testing agency.~~

919.4 Air. All air handled by direct gas-fired makeup air heaters, including combustion air, shall be brought in from outside.

Air to a direct gas-fired industrial air heater shall be ~~taken from the building,~~ ducted directly from the outdoors~~, or a combination of both~~.

Unless the industrial air heater incorporates a means to supply ventilation air, outside ventilation air shall be provided to supply at least ~~four (4)~~ ten (10) cubic feet per minute per 1000 Btu/h (16.11 L/s/kW) of rated input. If a separate mechanical means is used, an

interlock shall be provided so as not to permit main burner operation until the mechanical means is proved.

~~Recirculation of room air with an industrial air heater may be hazardous in the presence of flammable solids, liquids and gases; explosive materials (e.g., grain dust, coal dust, gun powder); and substances that may become toxic when exposed to heat (e.g., refrigerants, aerosols). Recirculation is not recommended in uninsulated buildings where the outside temperature falls below 32°F (0°C).~~

919.6 Filters. All air passing through or over the burners shall be outside air and screened or filtered to prevent leaves, papers or other objects from being picked up from the outside, ignited and discharged into the heated space. The screen or filter shall have a minimum mesh size of ½".

920.4 Reserved. ~~Electrical Equipment.~~ ~~All electrical equipment used as part of, or in connection with, the installation of a kiln shall comply with the requirements set forth in the Electrical Code.~~

920.5.2 Hoods. A canopy-type hood shall be installed directly above each kiln. The face opening area of the hood shall be equal to or greater than the top horizontal surface area of the kiln. The hood shall be constructed of not less than 0.024 inch (0.61 mm) (No. 24 U.S. gage) galvanized steel or equivalent and be supported at a height of between twelve (12) inches (305 mm) and thirty (30) inches (76 mm) above the kiln by noncombustible supports. Hoods shall exhaust directly to the outside of the building through an approved duct system. The exhaust shall be by gravity or mechanical means.

Exception: Electric kilns installed with listed exhaust blowers may be used when marked as being suitable for the kiln and installed in accordance with manufacturer's instructions.

921.0 General

Incinerators for the reduction of refuse, garbage or other waste materials shall be installed in accordance with the provisions of this chapter. Materials and structural design shall meet the requirements of the Building Code. Nothing in this part shall be construed to authorize the construction, placement, or use of any incinerator that is prohibited by state or federal environmental regulations or by other ordinances of the jurisdiction.

922.0 Small Domestic Type

922.1 General. Incinerators of small uninsulated domestic type installed indoors shall be constructed, mounted, installed and vented according to the applicable requirements for room heating stoves burning solid fuel and room heaters burning liquid fuel as specified in Chapters 3, 7, 8 and 9 of this code, except that mounting shall be on a noncombustible and fire-resistive floor, and minimum clearances to combustible materials shall be thirty-six (36) inches (914 mm) above, forty-eight (48) inches (1219 mm) in front and thirty-six (36) inches (914 mm) in back and at sides. The requirements of this section also apply to incinerators installed as a part of other appliances.

Incinerators of small domestic type, or those that are a part of another appliance, which have been tested and approved by an approved agency and listed for installation on a combustible floor or with lesser clearances shall be installed in accordance with the conditions of their listing and shall be connected to a chimney complying with the requirements of Chapter 8.

Exception: Existing unlined chimneys having at least four (4) inch (102 mm) nominal brick walls may be used for the venting of domestic gas-fired freestanding incinerators when such chimneys meet the other requirements of this chapter and have been approved and inspected by the Administrative Authority.

~~Outdoor incinerators of small domestic type and their locations shall be approved.~~

922.1.1 Outdoor Installations. All outdoor incinerators, including flues, shall be constructed as required for commercial-type incinerators, and outside incinerators shall be located as required by the Fire Code.

923.0 ~~Incinerators Using the Flue as a Refuse Chute~~

~~Incinerators in which no fuel other than normal refuse, except a gas flame or similar means to accomplish ignition, is used for combustion, and in which the chute and smoke flue are identical, shall have the enclosing walls of the combustion chamber constructed of clay or shale brickwork not less than four (4) inches (102 mm) thick when there is a horizontal grate area of not more than nine (9) square feet (0.84 m^2) and not less than eight (8) inches (203 mm) thick when there is a horizontal grate area exceeding nine (9) square feet (0.84 m^2) and, in each case, a lining of firebrick not less than four (4) inches (102 mm) thick, with an air space, in the case of the thicker wall, between the clay or shale brick and the firebrick sufficient to provide for expansion and contraction.~~

~~The combined chute and flue shall be constructed as required for incinerator chimneys in the Building Code. The chute and flue shall be constructed straight and plumb, and finished smooth on the inside. All flues shall terminate in a substantially constructed spark arrester having a mesh not exceeding ½ inch (12.7 mm).~~

~~Firebrick shall be laid in fireclay mortar.~~

~~Service openings into the chute shall be equipped with approved self-closing hoppers so constructed that the openings are closed off while the hopper is being charged and no part will project into the chute or flue. The area of the service opening shall not exceed one third of the area of the chute or flue.~~

Prohibited Installations

The use of a flue as a refuse chute shall not be allowed.

CHAPTER 10

STEAM AND HOT-WATER BOILERS

1002.0 Scope

The requirements of this chapter shall apply to the construction, installation, operation, repair and alteration of all boilers and pressure vessels related to steam and hot-water boiler systems.

Exceptions:

1. Listed and approved potable water heaters with a nominal capacity of 120 gallons (454 L) or less having a heat input of 200,000 Btu/h (58.62 kW) or less used for hot-water supply at pressure of 160 pounds per square inch (psi) (1103 kPa) or less and at temperatures not exceeding 210°F (99°C), as regulated by the Plumbing Code.
2. Pressure vessels used for unheated water supply, including those containing air which serves only as a cushion and is compressed by the introduction of water and tanks connected to sprinkler systems.
3. Portable unfired pressure vessels and I.C.C. containers.
4. Containers for liquefied petroleum gases, bulk oxygen and medical gas, which are regulated by the Fire Code.
5. Unfired pressure vessels in Groups B, F, H, M, R, S and U Occupancies having a volume of five (5) cubic feet (0.14 m^3) or less and operated at pressures not exceeding 250 psi (1724 kPa).
6. Pressure vessels used in refrigeration systems which are regulated by Chapter 11 of this code.
7. Pressure tanks used in conjunction with coaxial cables, telephone cables, power cables, and other similar humidity control systems.
8. Any boiler or pressure vessel subject to regular inspection by federal inspectors or licensed by federal authorities.

9. Coil-type hot water boilers where the water can flash into steam when released directly to the atmosphere through a manually operated nozzle may be exempted from the provisions of this section provided the following conditions are met.
    A. There is no drum, header, or other steam space;
    B. No steam is generated within the coil;
    C. Tubing outside diameter does not exceed 1 inch (25.4 mm);
    D. Pipe size does not exceed NPS 3/4;
    E. Nominal water capacity does not exceed 6 gallons (22.71 L);
    F. Water temperature does not exceed 350◦F (177◦C); and
    G. Adequate safety relief valves and controls are provided.

1004.0 Definitions

Certain words and terms used in this chapter, unless clearly inconsistent with their context, shall mean as follows:

ALTERATION. A change in an original design or configuration.

ASME CODE. The American Society of Mechanical Engineers Boiler and Pressure Vessel Code with addenda, code cases, and interpretations adopted by the council of the Society.

AUTHORIZED BOILER INSPECTOR. An inspector employed by an inspection agency, holding a commission issued by the commissioner of the State of Texas Department of Licensing and Regulation.

CONDEMNED BOILER. A boiler inspected and declared unfit for further service by the Administrative Authority.

DEPUTY INSPECTOR. An inspector appointed and deputized by the Administrative Authority.

DETACHED BOILER. Any class of boiler that remains in its original installed location and has been permanently disconnected from its energy source (i.e. natural gas, electricity, etc.)

ELECTRIC BOILER. A boiler in which the source of heat is electricity.

EXTERNAL INSPECTION. An inspection of the exterior of the boiler, its surroundings and its appurtenances.

INSPECTOR. The Administrative Authority, a deputy inspector, or an authorized inspector.

INTERNAL INSPECTION. As complete and thorough an inspection of the interior of a boiler as construction allows.

NATIONAL BOARD. The National Board of Boiler and Pressure Vessel Inspectors.

NATIONAL BOARD INSPECTION CODE. The manual for boiler and pressure vessel inspectors published by the National Board of Boiler and Pressure Vessel Inspectors.

NON-STANDARD BOILER. A boiler that does not qualify as a standard boiler.

PORTABLE BOILER. A boiler primarily intended for temporary use at a location.

REPAIR. The work necessary to restore a boiler or a pressure vessel to a safe and satisfactory operating condition, provided there is no deviation from the original design.

SAFETY APPLIANCES. Safety devices such as safety valves or safety relief valves (within the jurisdictional limits as prescribed by the Administrative Authority) provided for the purposes of diminishing the danger of accidents.

SECONDHAND BOILER. A boiler for which both the location and ownership have changed.

STANDARD BOILER. A boiler that bears the Texas stamp, the ASME stamp, or the stamp of any jurisdiction that has adopted a standard of construction equivalent to that required by the State of Texas.

***NOTE: All other portions of Section 1004 remain as set forth in the Uniform Mechanical Code.**

1005.0 Permit Required

Except for work exempted by Section 112.2 of this code, a permit shall be obtained from the Administrative Authority prior to installation, re-installation, alteration, repair or replacement of boilers and pressure vessels related to steam and hot water boiler systems. Alteration of safety control systems on automatic boilers or replacement, repair, or alteration of breeching, vent connector, vent pipe or chimney, and the conversion of solid-fuel-fired boilers as permitted by Section 1013.0 shall also required a permit. See Chapter 1 for requirements for obtaining permits.

1005.1 Moving Boilers. Any owner, user, or person desiring to remove, transfer, or relocate any boiler in the jurisdiction shall first obtain a new permit to install and have same inspected or tested by the Administrative Authority.

1005.2 Reinstallation. Any installed boiler in the jurisdiction may be reinstalled, provided an application is filed with the Administrative Authority and a permit granted as hereinafter provided. The boiler shall be inspected internally and a hydrostatic pressure test applied if deemed necessary by the Administrative Authority, after which, if conditions warrant, a permit to install shall be issued.

Exception: A horizontal return tubular boiler having continuous lap seam of more than 12 feet in length shall not be reinstalled for a gauge pressure in excess of 15 psi.

1005.3 Secondhand Boilers. All secondhand boilers shall be subject to inspection and shall be plainly numbered and tagged by the State of Texas for identification by the Administrative Authority before they are coated with paint or other preservative or offered for sale.

1005.4 Potable Water Boilers. Permits and inspections pertaining to boilers used exclusively for the production of potable hot water shall be administered by the Plumbing Inspection Section staff of the Administrative Authority. Permits and inspections pertaining to boilers used for other than the production of potable hot water shall be administered by the Mechanical Inspection Section staff of the Administrative Authority.

1006.1 Safety Requirements. The construction of boilers and pressure vessels used for steam and hot water boilers systems and the installation thereof shall conform to minimum requirements for safety from structural and mechanical failure and excessive pressures, established by the Administrative Authority in accordance with nationally recognized standards.

1006.2 Controls. Required electrical, mechanical, safety and operating controls components shall carry approval of an approved testing agency. Electrical controls shall be of such design and construction as to be suitable for installation in the environment in which they are located.

1006.3 Gages and Indicators. All steam boilers shall be provided with a pressure gage and a water level glass. All water boilers shall be provided with a pressure gage and a temperature indicator. All gages and indicators shall be installed in accordance with nationally recognized standards.

1006.5 Welding. Welding on pressure vessels or on boiler pressure-retaining boundaries shall be done by approved certified welders in conformity with nationally recognized standards. All such welding shall be subject to the approval of the Administrative Authority.

1006.6 Boiler Nameplate. A boiler nameplate shall be attached to each boiler. Lost or destroyed nameplates shall be replaced in accordance with The National Board Inspection Code.

1006.7 Automatic Controls. No low-pressure gas-fired boilers or furnace capable of consuming 200,000 Btu or more per hour shall be installed, and no boiler designed for other fuels having that Btu capacity shall be converted to the use of gas fuel unless equipped with either a thermostatic pilot light or other approved equipment constructed and adjusted so that no gas can flow through the main burner unless the pilot light is burning. In the case of a steam boiler, it shall be equipped with a low-water cutoff and an excess pressure switch to close the main gas supply valve on a low-water condition or an excess pressure condition. In the case of a hot-water boiler, it shall be equipped with a low-water fuel cutoff and an excess temperature switch to close the main gas supply valve on a low-water condition or an excess temperature condition. In the case of a forced or mechanical draft boiler, a means to prove air flow shall be provided to prevent gas flow to the main burner in the absence of air flow.

The operation of the pilot safety device shall not depend on the closing of an electrical circuit to shut off the main gas supply to the boiler.

1007.1 General. All hot-water-heating systems shall be provided with an air expansion tank securely fastened to the structure. Supports shall be adequate to carry twice the weight of the tank filled with water without placing any strain on connecting piping.

All hot-water heating systems incorporating hot water tanks or fluid relief columns shall be so installed as to prevent such items from freezing under normal operating conditions.

1007.2 Systems with Open Expansion Tanks. Systems equipped with an open expansion to tank satisfy thermal water expansion shall be provided with an indoor overflow from the upper portion of the expansion tank in addition to an open vent. The indoor overflow shall be carried within the building to a suitable plumbing fixture or ~~to the basement~~ plumbing drain.

1007.3 Closed-Type Systems. Systems of the closed type shall have an airtight tank or other suitable air cushion that will be consistent with the volume and capacity of the system, and shall be suitably designed for a hydrostatic test pressure two and one-half times the allowable working pressure of the system at the point the tank connects to the system. Expansion tanks for systems designed to operate at or above 30 psig shall be constructed in accordance with nationally recognized standards approved by the Administrative Authority. Provisions shall be made for draining the tank without emptying the system, except for pressurized tanks.

1008.0 Safety ~~or~~ and Safety Relief Valves ~~Discharge~~

1008.1 Safety and Safety Relief Valves. All safety valves used on boilers in the jurisdiction shall conform to the prescribed or recommendatory rules of the ASME Code and the State of Texas Boiler Law and shall have the necessary provisions so that the safety valve can be sealed in such a manner that the pressure-relieving mechanism of the safety valve cannot be changed, altered or adjusted unless the seal is broken.

1008.2 Authority to Set and Seal Safety Appliances. All safety and safety relief valves for ASME Section I, Section IV, and Section VIII Division 1 boilers must be repaired, tested, set, and sealed by one of the following, provided the scope of the issued certificate of authorization covers the work to be performed:

1. An organization holding a valid V, HV, or UV certificate of authorization, as appropriate, issued by the American Society of Mechanical Engineers (ASME);
2. An organization holding a valid VR certificate of authorization issued by the National Board of Boiler and Pressure Vessel Inspectors; or
3. An organization holding a valid owner/operator certificate of authorization issued by the Texas Department of Licensing and Regulation.

1008.3 Safety Valves and Safety Relief Valve Discharge.

The discharge from relief valves shall be piped to an approved location within eighteen (18) inches (457 mm) of the floor or to an open receptacle, and when the operating temperature

is in excess of 212°F (100°C), shall be equipped with a splash shield or centrifugal separator. When the discharge from safety valves would result in a hazardous discharge of steam inside the boiler room, such discharge shall be extended outside the boiler room. No valve of any description shall be placed between the safety or relief valve and the boiler, nor on the discharge pipe between the safety valve and the atmosphere. Discharge piping shall not be connected to any other piping system, and the cross-sectional area shall not be less than the full area of the valve outlet, or the total areas of the valve outlets discharging thereinto, whichever is greater. See also Section 1012.

1009.0 Gas Shutoff Valves

An approved manual shutoff valve with handle shall be installed within 3 feet of the boiler gas train, upstream of all control devices on the main burner of a gas-fired boiler. The takeoff point for the gas supply to the pilot shall be upstream of the gas shutoff valve of the main burner and shall be valved separately. A union or other approved means of disconnect shall be provided immediately downstream of these shutoff valves.

1011.1 Hot Water Heating Boilers. Hot-water-heating boilers, other than manually fired, shall be equipped with a low-water cutoff, except that a coil-type boiler or a water-tube boiler which requires forced circulation to prevent overheating of the coils or tubes shall have a flow-sensing device installed in the outlet piping in lieu of the low-water cutoff. The required low-water cutoff or flow switch, as applicable, shall be mounted so as to prevent damage to the boiler and to permit testing of the fuel-supply cutoff without draining the heating system, except that such boilers used in Group R Occupancies of less than six dwelling units and Group U Occupancies need not be equipped with the low-water cutoff or flow switch.

1011.2 Low-Water Fuel Cut Off and Feed Water Pump Control Combined in a Single Device. Where such a device is used, an additional separate low-water fuel cutoff with manual reset shall be installed. The additional control shall be wired in series electrically with the existing low-water fuel cutoff.

1011.3 Low-Water Fuel Cutoff Housed in Either the Water Column or Separate Chamber. The installation shall be provided with a blow down pipe and valve not less than 3/4 inch pipe size. The arrangement shall be such that when the water column is blown down, the water level in it will be lowered sufficiently to activate the low-water fuel cutoff device.

1011.4 Newly Installed Automatically Fired Hot Water Heating Boilers. Such boilers, when installed in a forced circulation system, shall be equipped in the manner described in this subsection and subsections 1011.2 and 1011.3. A coil-type boiler or a water-tube boiler requiring forced circulation to prevent overheating of the coils or tubes shall have a device to prevent burner operation if the flow rate becomes inadequate to protect the boiler unit from overheating.

1011.5 Water Feed Device. Where a water feed device is used, it shall be constructed to prevent feed water from entering the boiler through the water column or separate chamber of the low-water fuel cutoff.

1012.0 Combustion ~~Regulators – Safety Valves~~ Retroactive Requirements

The following requirements shall be retroactive:

1012.2 Boilers and pressure vessels shall be provided with the required number, size and capacity of safety or relief valves to ensure positive relief of overpressure in accordance with nationally recognized standards, as applicable. Valves so employed shall be constructed, sealed and installed in accordance with nationally recognized standards, as applicable. See Section 1008.

1013.0 Automatic Boilers

Automatic boilers shall be equipped with controls and limit devices as set forth in Table 10-3. ~~Automatic boilers shall also be equipped with the following gages, as applicable: oil~~

~~temperature, oil suction pressure, high and low gas pressure, stack temperature and windbox pressure.~~

Except as otherwise specified, all ~~gas-fired~~ boilers ~~exceeding 400,000 Btu/h (117 kW) input~~ shall conform to nationally recognized standards approved by the Administrative Authority.

The Administrative Authority may approve solid-fuel-fired boilers that can meet the safety requirements for automatic gas-or oil-fired boilers.

1014.0 Clearance for Access

When boilers are installed or replaced, clearance shall be provided to allow access for inspection, maintenance and repair. Passageways around all sides of boilers shall have an unobstructed width of not less than ~~eighteen (18) inches (457 mm)~~ 24 inches (610 mm). Clearance for repair and cleaning may be provided through a door or access panel into another area, provided the opening is of sufficient size. A minimum clearance of 48 inches (1220 mm) shall be maintained between top of a boiler and any building component. A minimum of 12 inches (305 mm) shall be maintained between the bottom of a scotch-type or locomotive-type boiler mud rim or wet bottom to the foundation or floor. The boiler mud rim or bottom of a vertical boiler shall be not less than six inches (153 mm) from the ground.

Exception: Subject to the approval of the Administrative Authority, boilers may be installed with a side clearance of less than ~~eighteen~~ twenty-four (~~18~~ 24) inches (~~457~~ 610 mm) , provided that the lesser clearance does not inhibit inspection, maintenance or repair.

~~Power boilers having a steam generating capacity in excess of 5000 pounds per hour (2268 kg/h) or having a heating surface in excess of 1000 square feet (93 m^2) or input in excess of 5,000,000 Btu/h (1465 kW) shall have a minimum clearance of seven (7) feet (2134 mm) from the top of the boiler to the ceiling.~~

~~Steam heating boilers and hot-water-heating boilers which exceed one of the following limits: 5,000,000 Btu/h input (1465 kW); 5000-pound-steam-per-hour (2268 kg/h) capacity~~

~~or 1000-square-foot (93 m²) heating surface; and power boilers which do not exceed one of the following limits: 5,000,000 Btu/h input (1465 kW); 5000-pound-steam-per-hour (2268 kg/h) capacity or 1000-square-foot (1465 kW) heating surface; and all boilers with manholes on top of the boiler, except those described in the second and fourth paragraphs shall have a minimum clearance of three (3) feet (914 mm) from the top of the boiler to the ceiling.~~

~~Package boilers, steam heating boilers and hot-water-heating boilers with no manhole on top of the shell and not exceeding one of the above limits shall have a minimum clearance of two (2) feet (610 mm) from the ceiling.~~

1015.0 Boiler Rooms and Enclosures

1015.1 General. Boiler rooms and enclosures and access thereto shall comply with Chapter 9, Part I of this Code and the Building Code.

1015.2 Roof. The roof over a boiler designed for indoor installation shall be free from leaks and maintained in good condition.

1015.3 Entrances and Exits. Entrances and exits or access to boilers and/or boiler rooms may not be through conditioned spaces that are under a negative pressure. This includes return-air plenum chambers, air conditioning intake areas and similar spaces.

Exception: Refrigeration machinery rooms.

1015.4 Placing of Boilers. Sufficient space shall be provided with boilers arranged and located such that the boilers can be maintained and repaired without removing permanent construction.

1019.0 Drainage

For ~~heating or hot water supply~~ all boiler applications, the boiler room shall be equipped with a floor drain or other means suitable for disposing of the accumulation of liquid wastes incident to cleaning, recharging and routine maintenance.

1020.0 Fuel Piping

Fuel piping shall conform to the Plumbing Code ~~Chapter 16 Part II, Referenced Standards – Tanks, piping and valves for oil-burning appliances, Chapter 2 and 3 of NFPA 31-1978, Standard for the Installation of Oil-Burning Equipment~~. Fuel oil piping shall conform to NFPA-31, 1978.

1021.0 Air for Combustion and Ventilation

Air for combustion and ventilation shall be provided in accordance with Chapter 7 of this code. Mechanical ventilating systems supplying air for combustion to rooms containing boilers shall supply not less than 15 cubic feet of air for each cubic foot of gas burned. The ventilation fan(s) shall be interlocked with the boiler controls.

1022.0 Operating Adjustments and Instructions

1022.1 Operating Instructions. ~~Hot water boiler installations~~ U~~u~~pon completion all boiler installations shall have controls set, adjusted and tested by the installing contractor. A complete control diagram of permanent legible type, together with complete boiler operating instructions, shall be furnished by the installer for each installation.

1022.2 Manufacturer's Instructions. The installation of each boiler covered by this chapter shall conform to the conditions of approval as specified in the manufacturer's installation instructions pertaining to safety and to the requirements of this chapter. The installer shall leave the manufacturer's instructions attached to the boiler or readily available for the benefit of the inspector.

1023.0 Inspections and Tests

1023.1 Inspections and Tests. An installation for which a permit is required shall not be put into service until it has been inspected and approved by the Administrative Authority.

It shall be the duty of the ~~owner or his~~ permit holder or his/her authorized representative to notify the Administrative Authority that the installation is ready for inspection and test. It also shall be the duty of the owner ~~or his~~, permit holder, or the authorized representative of

either to assure that ~~post in a conspicuous position on the installation a notice in substantially the following form: "Warning! This installation has not been inspected and approved by the Administrative Authority and shall not be covered or concealed until so inspected and approved," and it shall be unlawful for anyone other than the Administrative Authority to remove such notice.~~ the installation is not covered, or concealed, or operated until so inspected and approved by the Administrative Authority. The Administrative Authority shall require such tests as he deems necessary to determine that the installation complies with the provision of this code. Such tests shall be made by the ~~owner~~ permit holder or his authorized representative in the presence of the Administrative Authority.

Exception: On installations designed and supervised by a registered professional engineer, the Administrative Authority may ~~permit inspection and testing by such engineer in lieu of the above requirements~~ accept the written report bearing the engineer's seal of a hydrostatic test performed and/or witnessed by said engineer.

~~When the owner or his authorized representative requests inspection of a boiler prior to its installation, the Administrative Authority shall make such inspection.~~

1023.2 Inspection Codes and Standards. All inspections or tests shall be made in compliance with the prescribed or recommendatory rules or instructions of the this code, the ASME Code and the National Board Inspection Code as applicable. The installation or repair of gas and potable water piping and/or accessories shall be subject to the provisions of the Plumbing Code.

1023.3 Hydrostatic tests. A hydrostatic test is required for each second hand boiler or detached boiler being placed back into service. Such boilers shall be tested by hydraulic pressure, in accordance with the National Boiler Inspection Code, at 50 percent greater than their allowed safe working pressure. If for any reason or on account of leakage the boiler will not hold this pressure, the owner shall have all repairs made before the boiler is placed into service and the inspector shall witness a second test upon receipt of

notification that repairs have been made. If upon making the second test, the boiler is still defective, the Administrative Authority shall, for each subsequent test, collect an additional inspection fee as herein provided for, but in no case shall the Administrative Authority approve the boiler for use until fully satisfied of safe condition of such boiler. The installer or owner shall supply the equipment and labor to place the hydrostatic test on the boiler.

When there is a question or doubt about the condition of a boiler, the inspector may require a hydrostatic test, as follows:

1023.3.1 In preparing a boiler for a hydrostatic test, the boiler shall be filled with water to the stop valve and all air vented off. If the boiler to be tested is connected with other boilers that are under pressure, such connections shall be blanked off unless they have double stop valves on all connection pipes with a drain between.

1023.3.2 During a hydrostatic test of a boiler, the safety valve or valves shall be removed or each valve disc shall be held to its seat by means of a testing clamp and not by screwing down the compression screw under the spring.

1023.3.3 The temperature of the water used to apply a hydrostatic test shall be between 70° and 120° F.

1023.3.4 When a hydrostatic test is to be applied, the pressure shall be as follows:

1023.3.4.1 For all cases involving the question of tightness, the pressure shall be equal to the set pressure of the safety valve or valves having the lowest setting.

1023.3.4.2 For all cases involving the question of safety, the pressure shall be equal to one and one-half times the maximum allowable working pressure.

1023.3.4.3 The pressure applied for a hydrostatic test shall not exceed one and one-half times the maximum allowable working pressure In no case shall the test pressure be exceeded by more than 2.0 percent.

1023.4 Inspection, Non-standard Boilers. The Administrative Authority shall designate the manner of inspection for non-standard boilers, frequency of inspection, the form of inspection report, and the information reported.

1023.5 Special Inspections. The Administrative Authority may provide a special inspection as requested by owners, operators, installers, and manufacturers of boilers. The service may include surveys required for certification to assemble, install, or repair boilers within this jurisdiction. Special inspection fees shall be charged in accordance with Section 117 of the Building Code.

1023.6 Authorized Inspection. Inspection of repairs of pressure retaining boundaries of boilers and pressure vessels covered by insurance may be made by employees of the insuring company who hold commissions from the National Board of Boiler and Pressure Vessel Inspectors, subject to approval of the Administrative Authority. Approved insuring company inspectors shall make reports on prescribed forms on inspections authorized by the Administrative Authority. The reports shall be filed in the office of the Administrative Authority.

1024.0 Temporary Operating Permit

~~It shall be unlawful to operate a boiler or pressure vessel without first obtaining a valid operating permit to do so from the Administrative Authority. Such permit shall be displayed in a conspicuous place adjacent to the boiler or vessel. The operating permit shall not be issued until the equipment has been inspected and approved by the Administrative Authority.~~

~~**Exception:** The operation only of steam heating boilers, low-pressure hot-water-heating boilers, hot-water-supply boilers and pressure vessels in Group R Occupancies of less than six dwelling units and in Group U Occupancies.~~

An installer of a boiler installed by authority of a permit issued under the provisions of this code may operate the boiler and its appurtenances for a limited period of time for the purpose of cleaning, testing and adjusting, prior to passing final inspection, upon the following conditions:

1. The installer in whose name the permit is issued shall request the Administrative Authority to inspect the system for approval of such operation.

2. If upon inspection the system is approved for operation as described herein, the Administrative Authority shall indicate in writing on said permit that "temporary operation" is approved for the purpose of cleaning, testing, and adjusting for a period 30 working days from date of inspection.
3. On or before the expiration date of the temporary operating permit, the system shall be given a final inspection and if the system fails to be approved, a reinspection fee will be charged for each subsequent inspection until the system is finally approved as complying with the requirements of this code.
4. Should the cleaning, testing, and adjusting of a boiler system not be completed within the time stipulated on the temporary operating permit, the Administrative Authority may extend the time for just cause.

1025.0 ~~Maintenance Inspection~~ Repairs

~~The Administrative Authority shall inspect all boilers and pressure vessels operated under permit at such intervals as he deems necessary, but not less frequently than noted below:~~

1025.1 ~~Power boilers and miniature boilers shall be inspected externally annually. Where construction and operating conditions permit, they shall, in addition, be subject to inspection internally annually~~**. General.** Repairs, changes, or alterations made on a boiler shall conform with the prescribed or recommended rules of the ASME Code and the National Board Inspection Code and shall be subject to inspection, (visual and/or hydrostatic test), by the Administrative Authority before the boiler is coated with paint or other preservatives.

1025.2 ~~Steam heating boilers and hot water heating boilers shall be inspected externally annually. Where construction and operating conditions permit, they shall, in addition, be subject to inspection internally annually.~~ **Major Repair.** The term "major repair" as used herein shall be considered as one upon which the strength of a boiler would depend. Where a major repair is necessary, it shall be subject to the approval of the Administrative Authority. Repairs to all boilers and their appurtenances shall conform as nearly as

practicable to the requirements of the National Board Inspection Code. See Section 1025.6.

1025.3 ~~Automatic steam heating boilers shall be inspected externally biennially. Where construction and operating conditions permit, they shall, in addition, be subject to inspection internally biennially~~**. Repairs by Welding Fusion.** All repairs by welding shall be completed in accordance with the recommended rules for repair by fusion welding to power boilers published in the National Board Inspection Code.

1025.4 ~~Unfired pressure vessels shall be inspected externally biennially. When subject to corrosion and construction permits, they shall, in addition, be subject to inspection internally biennially~~**. Re-ending and Piecing Tube.** Re-ending or piecing tubes or pipes in either fire-tube or water-tube boilers is permitted, provided the thickness of the tube or pipe has not been reduced by more than 10 percent from that required by the ASME Code for the pressure to be carried.

~~Inspection of boilers and pressure vessels covered by insurance may be made by employees of the insuring company holding commissions from the National Board of Boiler and Pressure Vessel Inspectors, subject to approval of the Administrative Authority. Approved insuring company inspectors shall make reports on prescribed forms on inspections authorized by the Administrative Authority. The reports shall be filed in the Administrative Authority's office. Company inspectors shall notify the Administrative Authority of suspension of insurance because of dangerous conditions, new insurance in effect, and discontinuance of insurance coverage.~~

1025.5 Repairs and Renewal of Fittings and Appliances. Whenever repairs are made to fittings or appliances or it becomes necessary to replace them, the work must comply with this Code and ASME Code and National Board Inspection Code for new installations.

1025.6 Repair/Alteration Forms. Completed State of Texas R-1 welder forms for a boiler repair and/or alteration shall be submitted to the inspector before final approval.

1025.7 Leaks or Cracks. If there is evidence of a leak or crack, or any defect, the covering of the boiler shall be removed to satisfy the inspector as to the safety of the boiler. If the covering cannot be removed at that time, the inspector may order operation of the boiler to be discontinued until such time as the covering can be removed and a proper examination made.

1027.0 Electrical Boilers

1027.1 Installation. Installation shall comply with the provisions of this chapter. All electrical wiring, devices, and components shall be in compliance with the Electrical Code and the State of Texas Boiler Law.

1027.2 Safety Relief Capacity. The minimum safety or safety relief valve relieving capacity for electric boilers shall be 3 ½ pounds of steam per hour per kilowatt input.

1028.0 New and Existing Boiler Installations.

1028.1 New installations. New boiler installations, including reinstalled boilers, shall be in accordance with the requirements of the latest revision of the applicable section of the ASME Code and this code. Secondhand boilers shall meet all the requirements for new installations, including code construction and stamping requirements and shall be hydrostatically tested if deemed necessary by the Administrative Authority.

1028.2 Existing installations. The maximum allowable working pressure for standard boilers shall be determined in accordance with the applicable provisions of the edition of the ASME Code under which they were constructed and stamped. In no case shall the maximum pressure of an existing nonstandard boiler be increased to a greater pressure than would be allowed for a new boiler of the same construction.

1028.3 Makeup water connection to steam boilers. Approved backflow preventers shall be installed in accordance with the Plumbing Code.

1028.4 Boiler Discharge to Plumbing Systems. No steam pipe shall connect to any part of a drainage or plumbing system, nor shall any water above 140°F. (60°C.) be discharged into any part of a drainage system. Such pipes shall be indirectly connected by discharging into an interceptor, blowoff pit or similar appurtenances prior to delivery into the drainage system.

TABLE 10-3
Controls and Limit Devices for Automatic Boilers

Boiler Group	Fuel	Fuel Input Range [1] (Inclusive), Btu/h	Type of Pilot[2]	Safety Control Timing				Assured Fuel Supply Control[4]	Assured Air Supply Control[5]	Low Fire Start Up Control[6]	Pre Purging Control [7]	Hot Water Temperature and Low Water Limit Controls [8]	Steam Pressure and Low Water Limit Controls [9]	Approved Fuel Shutoff [10]	Control and Limit Device System Design [11]
				Type of Pilot	Trial for Main Burner Flame		Main burner flame Failure[3]								
					Direct Electric Ignition	Flame Pilot									
A	Gas	0-400,000	any type	90	not required	90	90	not required	required	not required	not required	Required	Required	not required	Required
B	Gas	400,001-2,500,000	Interrupted or intermittent	15	15	15	2-4	not required	required	not required	not required	Required	Required	not Required	Required
C	Gas	2,500,001-5,000,000	Interrupted or intermittent	15	15	15	2-4	required	required	required	required	Required	Required	Required	Required
D	Gas	over 5,000,000	interrupted	15	15	15	2-4	required	required	required	required	Required	Required	Required	Required
E	Oil	0-400,000	Any type	not required	90	90	90	not required	required	not required	not required	Required	Required	Not Required	Required
F	Oil	400,001-1,000,000	Interrupted	not required	30	30	2-4	required	required	not required	not required	Required	Required	Not Required	Required
G	Oil	1,00,001-3,000,000	Interrupted	not required	15	15	2-4	required	required	not required	not required	Required	Required	Not Required	Required
H	Oil	over 3,000,000	Interrupted	15	15	60	2-4	required	required	required	required	Required	Required	Required	Required
K	Electri	All	Not required	not required	not required	not required	not required	not required	not required	not required	not required	Required	Required	Not Required	Required

	c														

1. Fuel input shall be determined by one of the following:
   (a) The maximum burner input as shown on the burner nameplate or as otherwise identified by the manufacturer.
   (b) The nominal boiler rating, as determined by the ~~building official~~ Administrative Authority, plus twenty-five percent (25%).

2. Automatic boilers shall have one flame failure device on each burner which shall prove the presence of a suitable ignition source at the point where it will reliably ignite the main burner, except that boiler groups A, B, E, F and G which are equipped with direct electric ignition shall monitor the main burner, and all boiler groups using interrupted pilots shall monitor only the main burner after the prescribed limited trial and ignition periods. Boiler group A, equipped with continuous pilot, shall accomplish 100 percent shutoff within ninety (90) seconds upon pilot flame failure. The use of intermittent pilots in boiler group C is limited to approved burner units.

3. In boiler groups B, C and D a 90-second main burner flame failure limit may apply if continuous pilots are provided on manufacturer assembled boiler-burner units which have been approved by an approved testing agency as complying with nationally recognized standards approved by the ~~building official~~ Administrative Authority. Boiler groups F and G equipped to re-energize their ignition systems within 0.8 second after main burner flame failure will be permitted thirty (30) seconds for group F or fifteen (15) seconds for group G to reestablish their main burner flames.

4. Boiler groups C and D shall have controls interlocked to accomplish a nonrecycling fuel shutoff upon high or low gas pressure, and boiler groups F, G and H using steam or air for fuel atomization shall have controls interlocked to accomplish a nonrecycling fuel shutoff upon low atomizing steam or air pressure. Boiler groups F, G and H equipped with a preheated oil system shall have controls interlocked to provide fuel shutoff upon low oil temperature.

5. Automatic boilers shall have controls interlocked to shut off the fuel supply in the event of draft failure if forced or induced draft fans are used or, in the event of low combustion air flow, if a gas power burner is used. Where a single motor directly driving both the fan and the oil pump is used, a separate control is not required.

6. Boiler groups C, D and H, when firing in excess of 400,000 Btu per combustion chamber, shall be provided with low fire start of its main burner system to permit smooth light-off. This will normally be a rate of approximately one third of its maximum firing rate.

7. Boiler groups C, D and H shall not permit pilot or main burner trial for ignition operation before a purging operation of sufficient duration to permit a minimum of four complete air changes through the furnace, including combustion chamber and the boiler passes. Where this is not readily determinable, five complete air changes of the furnace, including combustion chamber up to the first pass, will be considered equivalent. An atmospheric gas burner with no mechanical means of creating air movement or an oil burner which obtains two thirds or more of the air required for combustion without mechanical means of creating air movement shall not require purge by means of four air changes, so long as its secondary air openings are not provided with means of closing. If such burners have means of closing secondary air openings, a time delay must be provided which puts these closures in a normally open position for four minutes before an attempt for ignition. An installation with a trapped combustion chamber shall, in every case, be provided with a mechanical means of creating air movement for purging.

8. Every automatic hot-water-heating boiler, low-pressure hot-water-heating boiler, and power hot-water boiler shall be equipped with two high-temperature limit controls with a manual reset on the control, with the higher setting interlocked to shut off the main fuel supply, except that manual reset on the high-temperature limit control shall not be required on any automatic package boiler not exceeding 400,000 Btu/h input and which has been approved by an approved testing agency. Every automatic hot-water heating, power boiler and package hot-water supply boiler shall be equipped with one low-water level limit

control with a manual reset interlocked to shut off the fuel supply so installed as to prevent damage to the boiler and to permit testing of the control without draining the heating system, except on boilers used in Group R Occupancies of less than six units and in Group U Occupancies and further, except that the low-water level limit control is not required on package hot-water supply boilers approved by a nationally recognized testing agency. However, a low-water flow limit control installed in the circulating water line may be used instead of the low-water level limit control for the same purpose on coil-type boilers.

9. Every automatic low-pressure steam-heating boiler~~, small power boiler~~ and power steam boiler shall be equipped with two high steam pressure limit controls interlocked to shut off the fuel supply to the main burner with manual reset on the control, with the higher setting and two low-water-level limit controls, one of which shall be provided with a manual reset device and independent of the feed water controller. Coil-type flash steam boilers may use two high-temperature limit controls, one of which shall be manually reset in the hot-water coil section of the boiler instead of the low-water level limit control.

10. Boiler groups C, D and H shall use an approved automatic reset safety shutoff valve for the main burner fuel shutoff which shall be interlocked to the programming control devices required. On oil burners where the safety shutoff valve will be subjected to pressures in excess of ten (10) psi when the burner is not firing, a second safety shutoff valve shall be provided in series with the first. Boiler groups C and D using gas in excess of one (1) pound-per-square-inch pressure or having a trapped combustion chamber or employing horizontal fire tubes shall be equipped with two approved safety shutoff valves, one of which shall be an automatic reset type, one of which may be used as an operating control, and both of which shall be interlocked to the limit-control devices required. Boiler groups C and D using gas in excess of one (1) pound-per-square-inch pressure shall be provided with a permanent and ready means for making periodic tightness checks of the main fuel safety shutoff valves.

11. Control and limit device systems shall be grounded with operating voltage not to exceed 150 volts, except that, upon approval by the~~ building official~~ Administrative Authority, existing control equipment to be reused in an altered boiler control system may use 220-volt single phase with one side grounded, provided such voltage is used for all controls. Control and limit devices shall interrupt the ungrounded side of the circuit. A readily accessible means of manually disconnecting the control circuit shall be provided with controls so arranged that when they are de-energized, the burner shall be inoperative.

CHAPTER 11

REFRIGERATION

1101.0 Scope

Part I of this chapter covers refrigeration systems. Refrigeration systems, equipment and devices for new buildings, ~~including the replacement of parts, alterations and substitution of a different refrigerant,~~ shall conform to the requirements of this chapter and other applicable provisions of this code. Replacement of existing refrigeration systems, conversion to a different refrigerant or installation of a new refrigeration system into an existing building shall conform to the requirements of this chapter as modified by Section 1126.

Occupied spaces within refrigerated areas shall comply with this chapter and the applicable portions of the Building Code.

Part II covers cooling towers.

1104.0 Classification of Refrigeration Systems

Refrigeration systems shall be classified according to the degree of probability that a leakage of refrigerant could enter a normally occupied space ~~area~~. Normally occupied space does not include refrigeration machinery rooms, engine rooms, boiler rooms, switchgear rooms and similar spaces that are normally accessible only to authorized personnel.

1105.2 Volume of Occupied Space. The quantity of refrigerant in a single, independent circuit of a high-probability system shall not exceed the amounts shown in Table 11-1 based on the volume of the normally occupied space. The volume of the smallest, enclosed, normally occupied space shall be used to determine the permissible quantity of refrigerant in a system which is located in, serves or passes through such space.

Exceptions:

1. If the airflow to any enclosed space served by a portion of an air-duct system cannot be shut off or reduced below one quarter of its maximum~~.~~, the cubical contents of the entire space served by that portion of the air-duct system ~~shall~~ may be used to determine the permissible quantity of refrigerant in the system.
2. Refrigerated process or storage areas meeting the requirements of Section 1105.3.

1105.3.1 The refrigerated room or space is equipped with a refrigerant vapor detection and alarm system complying with Section 1121.0, and alarm enunciating devices are located as required for machinery rooms in Section 1107.4.

1105.4 Reserved~~. Refrigerant Purity.~~ ~~New and reclaimed refrigerants are allowed to be used in refrigeration systems in accordance with this section. When requested, the installer shall furnish a declaration identifying the refrigerant by standard "R-" designation and stating that it meets the requirements of either Sections 1105.4.1 or 1105.4.2.~~

~~**Exception:** The refrigerant used shall meet the purity specifications set by the manufacturer of the equipment in which it is used when that specification is different from Sections 1105.4.1 or 1105.4.2.~~

~~**1105.4.1 New and Reclaimed Refrigerants.** New and reclaimed refrigerants shall meet the referenced standard for refrigerant specifications in Chapter 16, Part II.~~

~~**1105.4.2 Recovered Refrigerants.** Re-use of recovered refrigerant that shows no sign of contamination is allowed, provided that it has been filtered and dried with a listed or approved recovery machine, in equipment belonging to the same owner as the equipment from which it was removed. Recovered refrigerants shall not be used in a different owner's equipment unless the refrigerant has been analyzed and found to meet the purity requirements of Section 1105.4.1.~~

1106.3 Access. An unobstructed readily accessible opening and passageway not less than ~~thirty-six (36)~~ twenty-four (24) inches (~~914~~ 609.6 mm) in width and six (6) feet ~~(1829 mm) eight (8)~~ six (6) inches (~~203~~ 1981.2 mm) in height shall be provided and maintained to the compressor, valves required by this chapter or other portions of the system requiring routine maintenance.

Exceptions:

1. Refrigerant evaporators, suspended overhead, may use portable means of access.
2. Air filters, brine control or stop valves, fan motors or drives, and remotely deenergized electrical connections may be provided access by an unobstructed space not less than thirty (30) inches (762 mm) in depth, width and height. When an access opening is immediately adjacent to these items and the equipment can be serviced, repaired and replaced from this opening, the dimensions may be reduced to twenty-two (22) inches (559 mm) by thirty (30) inches (762 mm) provided the largest piece of equipment can be removed through the opening.
3. Cooling equipment, using Group A1 refrigerants or brine, located in an attic or furred space may be provided access as for furnaces in Section 908.0 of this code.
4. Cooling or refrigeration equipment, using Group A1 or B1 refrigerants or brine, located on a roof or on an exterior wall of a building may be provided access as for furnaces in Section 910.0 of this code.

1106.4 Reserved~~. Illumination and Service Receptacles.~~ ~~In addition to the requirements of Section 309.0, permanent lighting fixtures shall be installed for all equipment required by this code to be accessible or readily accessible. Such fixtures shall provide sufficient illumination to safely perform the required tasks for which access is provided. Control of the illumination source shall be provided at the access entrance.~~

~~**Exceptions:**~~

~~1. Lighting fixtures may be omitted when the fixed lighting of the building will provide the required illumination.~~

~~2. Equipment located on the roof or on the exterior walls of a building.~~

1106.6 Electrical. Electrically energized components of refrigeration systems shall be listed or conform to the Electrical Code.

1106.8 Prohibited Locations. Refrigeration systems or portions thereof shall not be located within a required exit enclosure. Refrigeration compressors exceeding five (5) horsepower (3.68 kW) rating which contain other than A1 refrigerants shall be located at least ten (10) feet (3048 mm) from an exit opening in a Group A; Group B; Group E; Group F; Group H Group I; Group R, Division 1 or 2; or Group S Occupancy unless separated by a one-hour fire resistive occupancy separation.

1106.10 Condensate. Condensate from air-cooling coils shall be collected and drained to an approved location. Drain pans and coils shall be arranged to allow thorough drainage and access for cleaning. ~~Where temperatures can drop below freezing, heat tracing and insulation of condensate drains shall be installed~~. Primary drain piping inside buildings shall be insulated for the first 15 feet horizontally from the drain pan. The insulation shall be a minimum of ½" in thickness.

1106.11 Defrost. When defrost cycles are required for portions of the system. ,provisions shall be made for collection and disposal of the defrost liquid in a safe and sanitary manner.

1107.1.1 ~~The quantity of refrigerant in a single, independent refrigerant circuit of a system exceeds Table 11-1 amounts~~. **Where required.** A refrigeration machinery room is not required if all components of a refrigeration system are located outdoors at least 20 feet from a door, operable window or ventilation opening into a building and at least 15 feet from any property line not adjoining a public way. In other than the

foregoing outdoor locations, all interior or exterior refrigeration systems shall be provided with a refrigeration machinery room when any of the following conditions exist:

1107.1.1.1 The quantity of refrigerant in a single system exceeds Table 11-1 amounts;

1107.1.1.2 Absorption refrigeration equipment is used (see Section 1128);

1107.1.1.3 A Group A1 system having an aggregate compressor horsepower of 100 or more is used; or

1107.1.1.4 The system contains other than a Group A1 refrigerant.

~~**1107.1.2** Direct-and indirect-fired absorption equipment.~~

Exceptions:

~~1. Systems containing less than thirty-five (35) pounds (16 kg) of refrigerant R-717 and located in an approved exterior location.~~

~~2. Direct and indirect-fired lithium bromide absorption systems using water as the refrigerant.~~

Refrigeration machinery rooms shall house all refrigerant-containing portions of the system other than the piping and evaporators permitted by Section 1105.3, discharge piping required of this chapter, and cooling towers regulated by this chapter, Part II, and their essential piping.

~~**1107.1.3** An A1 system having an aggregate combined compressor horsepower of 100 (73.55 kW) or more.~~

1107.2 Dimensions. Refrigeration machinery rooms shall be of such dimensions that all system parts are readily accessible with adequate space for maintenance and operations. An unobstructed walking space at least ~~three (3)~~ two (2) feet (~~914~~ 609.6 mm) in width and six (6) feet ~~eight~~ six (~~8~~ 6) inches (~~2032~~ 1981.2 mm) in height shall be maintained throughout, allowing free access to at least two sides of all moving machinery and approaching each stop valve.

Exception: Existing installations being modified need not comply if reduced clearances meet the listing conditions of the equipment or appliance.

Access to refrigeration machinery rooms shall be restricted to authorized personnel and posted with a permanent sign.

1107.4 Refrigerant-Vapor Alarms. Machinery rooms shall have approved refrigerant-vapor detectors, located in an area where refrigerant from a leak is likely to concentrate, and shall activate visual and audible alarms. Alarms shall be activated at a value not greater than one half the immediately dangerous to life or health (IDLH), or measurement consistent therewith; the PEL, or measurement consistent therewith; or 25 percent of the LFL, whichever is less. A refrigerant-vapor detection system and alarm system for the specific refrigerant(s) shall be installed and shall utilize alarm-signaling devices providing a sound pressure level of at least 15 dBA above the operating ambient noise level within the room, and providing a distinctive visual alarm both inside and outside the machinery room at each entrance. Upon detection of refrigerant levels as specified in Section 1108.5, the refrigerant sensor(s) shall energize the emergency ventilation system and automatically de-energize refrigeration machines and other motorized equipment in the room.

1107.5 Separation. Refrigeration machinery rooms shall be separated from other portions of the building as required in ~~the special hazards provisions~~ Table 302.1.1 of the Building Code. Penetrations shall be sealed to inhibit the passage of refrigerant vapor.

1108.2.1 Continuously maintain the refrigeration machinery room at ~~0.05 inch (12.44 Pa) water gauge~~ a negative pressure relative to adjacent spaces. ~~calculated by:~~

~~$Q = 2610.A_e\sqrt{p}$~~ **{Formula (11-1) is not adopted by this jurisdiction}**

~~(11-1)~~

Exception: Refrigeration machinery rooms located in entirely detached structures and more than twenty (20) feet (6096 mm) from property lines or openings into buildings.

1108.2.2 Continuously provide ~~0.5~~ .10 cubic foot per minute of air flow per gross square foot (2.54 L/s/m²) of floor area within the refrigeration machinery rooms as calculated by:

$$Q = 0.5\ 0.1 A_{gf} \quad (11\text{-}2)$$

1108.2.3 Limit the temperature rise within the refrigeration machinery room to a maximum of ~~104°F (40°C)~~ 18°F (-8°C) as calculated by:

$$Q = \sum q/(18)(1.08)\triangle T \quad (11\text{-}3)$$

1108.2.4 Provide emergency purge of escaping refrigerant as calculated by:

$$Q = 100 \sqrt{G}$$

WHERE:

q = Btu/h of all heat-producing equipment.

Q = air-flow rate, cubic feet per minute (cfm).

~~$\triangle p$ = pressure difference, inches water gage.~~

~~Ae = equivalent leakage area, square feet (see the Building Code).~~

Agf = gross floor area, square feet.

~~$\triangle T$ = temperature difference between machinery room and supply air (°F).~~

G = refrigerant mass in largest system, lbs.

1108.3 Distribution of Ventilation. ~~Exhaust~~ Makeup air inlets or permanent openings shall be located to provide ventilation throughout the entire refrigeration machinery room.

1108.5 Emergency Control of the Ventilation Systems. Fans providing emergency purge ventilation for refrigerant escape shall have a clearly identified switch ~~of the break-glass type~~ providing "on"-only control immediately adjacent to within two feet of the strike side of the door ~~and~~ inside or outside of each refrigerant machinery room exit. Switches located outside the machinery room shall be of the break-glass type. Purge fans shall also respond automatically to the refrigerant concentration detection system set to activate the ventilation system at no more than 25 percent of the LFL or 50 percent of the IDLH or a measure equivalent thereto, whichever is less. An emergency purge control shall be provided with a manual reset only.

1108.6 Reserve~~. Central Control of Ventilation Systems.~~ ~~Mechanical ventilation systems shall have switches to control power to each fan. The switches shall be key operated or within a locked glass-covered enclosure at an approved location adjacent to and outside of the principal entrance to the machinery room. Necessary keys shall be located in a single approved location. Switches controlling fans providing continuous ventilation shall be of the two position, on-off type. Switches controlling fans providing intermittent or emergency ventilation shall be of the three position, automatic on-off type. Switches shall be labeled identifying both function and specific fan controlled. Two colored and labeled indicator lamps responding to the differential pressure created by air flow shall be provided for each switch. One lamp shall indicate flow, the other shall indicate no flow.~~

1108.7 Ventilation Discharge. Exhaust from mechanical ventilation systems shall be discharged at least 10 feet (3048 mm) above grade and twenty (20) feet (6096 mm) from a property line or openings into buildings. For other than A1 and B1 refrigerants listed in Table 11-1, ~~D~~ discharges capable of exceeding 25 percent of the LFL or 50 percent of the IDLH, shall be equipped with approved treatment systems to reduce the discharge concentrations to these values or lower.

Exception: When an approved engineering analysis of plume dispersion demonstrates that the limiting values will not be exceeded at the property line.

1108.8 Fans. Fans and associated equipment intended to operate the emergency purge of other than Group A1 or Group B1 refrigerants shall meet the requirements for a Class I, Division 1 hazardous location as specified in the Electrical Code, and shall be spark resistant and of AMCA Division B rating or better.

1108.9 Ventilation Intake. Make-up air intakes to replace the exhaust air shall be provided to the refrigeration machinery room directly from outside the building. Intakes shall be located as required by other sections of the code. ~~and~~ For other than A1 or B1 refrigerants, intakes shall be fitted with backdraft dampers or similar approved flow-control means to prevent reverse flow. Distribution of make-up air shall be arranged to provide thorough mixing within the refrigeration machinery room to prevent short circuiting of the make-up air directly to the exhaust.

1109.1 General. Equipment, piping, ducts, vents or similar devices which are not essential for the refrigeration process, maintenance and operation of the equipment or for the illumination, ventilation or fire protection of the room shall not be placed in or pass through a refrigeration machinery room.

Equipment essential to the refrigeration process often includes, but is not always limited to, the following:

1109.1.3 Pumps, associated water treatment piping and automatic control valves for refrigerant, condenser water, and brine or chilled water.

1109.1.12 Control air compressor and accessories.

1109.2 Electrical. Electrical equipment and installations shall comply with the Electrical Code. The refrigeration machinery room shall not be required to be a hazardous (classified) location except as provided in Section 1108.8. or wherein the refrigerant is other than Class 1.

1109.3 Storage. Storage of materials in a refrigeration machinery room shall be as permitted in the Fire Code. Refrigerants in excess of the amounts within an approved refrigeration system may be stored in a refrigeration machinery room in their original DOT containers or in vessels stamped in accordance with ASME Section 8. Such storage shall not exceed an amount equal to the total amount of refrigerant contained within all refrigeration machines in the machinery room.

1109.4 Emergency Control. For machinery rooms containing other than A1 and/or B1 refrigerants ~~A~~ a clearly identified switch ~~of the break-glass type~~ providing "off"-only control of electrically energized equipment and devices within the refrigeration machinery room shall be provided immediately adjacent to or within 2 feet of the strike side of the door inside ~~and~~ or outside of each refrigeration machinery room exit. Switches located outside the machinery room shall be of the break-glass type. In addition, emergency shut off shall also be automatically activated when the concentration of refrigerant vapor exceeds 25 percent of the LFL.

1110.2 Nonferrous Materials. Copper and brass refrigeration piping, valves, fittings and related parts used in the construction and installation of refrigeration systems shall be ~~approved~~ suitable for the intended use.

1110.3 Ferrous Materials. Iron and steel refrigeration piping, valves, fittings and related parts shall be ~~approved~~ suitable for the intended use. Pipe more than two (2) inches (50 mm) iron pipe size shall be electric-resistance welded, submerged arc welded or seamless pipe. (See U.M.C. Standard 11-3 in Appendix A.)

1111.3 Protection From Damage. Refrigerant piping and tubing shall be installed so that it is not subject to damage from an external source. Soft annealed copper tubing shall not be larger than 1-3/8 inch (35 mm) nominal size. Mechanical joint shall not be made on tubing larger than 3/4 inch (20 mm) nominal size. Where subject to damage, ~~S~~ soft annealed copper tubing conveying refrigerant shall be enclosed in iron or steel piping and

fittings or in conduit~~.~~, molding or raceway which will properly protect the tubing against mechanical injury from an exterior source.

Exceptions:

1. Tubing entirely within or tubing within five (5) feet (1524 mm) of a refrigerant compressor when so located that it is not subject to external injury.
2. Copper tubing serving a dwelling unit, when such tubing contains Group A1 refrigerant and is placed in locations not subject to damage from an external source.

1111.4 Visual Inspection. Refrigerant piping and joints shall be exposed to view for visual inspection and acceptance by the Administrative Authority prior to being covered or enclosed.

Exception: Soft annealed copper tubing enclosed in ~~iron or steel~~ piping conduit, molding or raceway, provided there are no fittings or joints concealed therein.

1111.7 Joints. Iron or steel pipe joints shall be of ~~approved~~ suitably threaded, flanged or welded types. Exposed threads shall be tinned or coated with a~~n approved~~ suitable corrosion inhibitor. Copper or brass pipe joints of iron pipe size shall be of ~~approved~~ suitably threaded, flanged or brazed types. Copper tubing joints and connections shall be ~~approved~~ suitably flared, lapped, swaged or brazed joints.

~~**1111.8 Identification.** Piping shall be identified in accordance with U.M.C. Standard No. 11-2. The type of refrigerant, function and pressure shall be indicated.~~

~~**1112.1.1** At the inlet and outlet of a positive displacement type compressor, compressor unit or condensing unit.~~

~~**1112.1.2**~~ At the refrigerant outlet from a liquid receiver.

~~**1112.1.3**~~ **1112.1.2** At the refrigerant inlet of a pressure vessel containing liquid refrigerant and having an internal gross volume exceeding three (3) cubic feet (108 m^3).

Exceptions:

1. Systems with nonpositive-displacement compressors.
2. Systems having a pump-out receiver for storage of the charge.
3. Systems containing less than 110 pounds (49.9 kg) of Group A1 refrigerant.
4. Self-contained systems do not require a stop valve at the inlet of the receiver or the discharge of the compressor.

~~**1112.3 Access.** Stop valves required by this section shall be readily accessible from the refrigeration machinery room floor or a level platform.~~

~~**1112.4 Identification.** Stop valves shall be identified by tagging in accordance with U.M.C. Standard No. 11-2. A valve chart shall be mounted under glass at an approved location near the principal entrance to a refrigeration machinery room.~~

1117.8 Discharge Location. Pressure-relief devices shall discharge to the atmosphere unless otherwise prohibited by this chapter at a location at least fifteen (15) feet (4572 mm) above the adjoining grade level and at least twenty (20) feet (6096 mm) from an opening into a building or a property line not adjoining a public way. The discharge termination shall be fitted with an approved diffuser directed to prevent spray of discharged refrigerant on personnel or entry of foreign material or water into the discharge piping. Discharge piping connected to the discharge side of a fusible plug or rupture member shall have provisions to prevent internal plugging of the pipe caused by the fusible plug or rupture member function.

Exceptions:

1. Systems containing less than 110 pounds (49.9 kg) of a Group A1 refrigerant.
2. A pressure-relief valve may discharge into the low side of the system, if the pressure-relief valve is of a type not affected by back pressure provided the low side is equipped with pressure-relief devices of equal relieving capacity. The

low-side pressure-relief device shall be set and discharged as required by this section. Fusible plugs or rupture members shall not be used for pressure relief into the low side.

1119.1 General. Systems containing other than Group A1 or B1 refrigerants shall discharge to atmosphere only through an approved flaring device. For water treatment requirements also see the Fire Code.

Exceptions:

1. Ammonia systems complying with Section 1120.0.
2. Ammonia absorption systems serving ~~a single dwelling unit~~ 5 tons or less.
3. When the Administrative Authority determines upon review of a rational engineering analysis that significant fire, health or environmental hazard would not result from the proposed atmospheric release.
4. Lithium bromide absorption system using water as the refrigerant.

1120.0 Ammonia Discharge

Ammonia shall discharge into a tank of water which shall be used for no purpose except ammonia absorption. At least one (1) gallon (3.785 L) of fresh water shall be provided for each pound (454 g) of ammonia in the system. The water used shall be prevented from freezing without the use of salt or chemicals. The tank shall be substantially constructed of not less than 1/8-inch (3.2 mm) or No. 10 M.S.G. steel. The horizontal dimensions of the tank shall be equal to or less than one half the height. The tank shall have a hinged cover or, if of the enclosed type, shall have a vent hole at the top. Pipe connections shall be through the top of the tank. The discharge pipe from the pressure-relief valves shall discharge ammonia in the center of the tank near the bottom but not more than thirty (30) feet (9144 mm) below the surface of the water.

Exception: An ammonia-water absorption unit system installed outdoors of 5 tons or less ~~serving a dwelling unit~~ provided the discharge is shielded and dispersed.

1121.1 General. When required by this chapter, approved refrigerant-vapor detection and alarm systems shall utilize alarm signaling devices providing a sound pressure level of at least 15 dBA above the operating ambient noise sound pressure level of the space in which they are installed and providing an approved, distinctive audible and visual alarm. Alarms shall be activated within the space and as required in Section 1121.3 below whenever the refrigerant vapor PEL is exceeded. In other than machinery rooms, such systems shall also automatically stop the flow of refrigerant to evaporators within the space and stop the flow of refrigerant in all supply lines leaving the machine room whenever the refrigerant vapor concentration is detected at or above 50 percent of the IDLH or 25 percent of the LEL. For other than A1 and B1 refrigerants appearing in Table 11-1 ~~D~~ detection of refrigerant vapor concentrations at or above 25 percent of the LEL shall automatically de-energize all electrical power within the space which does not meet the requirement for a Class I. Division 1, Group D electrical installation.

1121.3 Annunciation. Detection and alarm systems shall be annunciated for all refrigerants at an approved location in accordance with the Fire Code and annunciated remotely if the fire alarm system is remotely annunciated.

1122.2 In a refrigeration machinery room and for a direct refrigerating system of more than ten (10) horsepower (7.457 kW), there shall be a permanent sign ~~at an approved location~~ located on or adjacent to the primary machinery room door and on each condensing unit in ½-inch-high letters giving the following information:

1122.2.1 ~~Name of contractor installing equipment.~~

~~1122.2.2~~ Name and number designation of refrigerant in system.

1122.2.2 ~~1122.2.3~~ Pounds of refrigerant in system.

1123.2 Field Tests. Refrigerant-containing parts of a system that is field erected shall be tested and proved tight to the satisfaction of the Administrative Authority after complete installation and before operation. The high and low side of each system shall be tested and proved tight at not less than the lower of the pressure in Table 11-4 or the setting of the pressure-relief device.

Exceptions:

1. Compressors, condensers, evaporators, coded pressure vessels, safety devices, pressure gages, control mechanisms and systems that are factory tested.
2. Refrigeration systems containing an A1 refrigerant, ~~R-22~~, not exceeding 25 tons of refrigeration capacity (~~17.58~~ 87.9 kW). ~~and field piped using approved, factory charged line sets may be proved tight by observing retention of pressure on a set of charging gages and soaping connections while the system is operating.~~

1125.0 Storage of Refrigerants and Refrigerant Oils

Refrigerants and refrigerant oils not charged within the refrigeration system shall be stored as required by the Fire Code and Section 1109.3.

1126.0 Requirements for Modifications to Existing Buildings

1126.1 General. The requirements of this section shall apply retroactively to existing refrigeration systems, equipment or devices where a substitution of a different refrigerant or a replacement or addition of a refrigeration system or equipment occurs, and:

1. The quantity of refrigerant in the largest system in the room exceeds Table 11-1 amounts; or
2. The replaced, converted or altered system contains A1 refrigerant and has an aggregate horsepower of 100 or more for a single refrigerant system; or
3. The system contains other than A1 refrigerant.

Exception: Absorption systems, see Section 1128.

1126.2 Permits. Notwithstanding the exemptions to the permit requirements set forth in Section 112, a mechanical permit shall be obtained for the replacement or addition of equipment, for conversion to another A1 refrigerant if mechanical refrigerating equipment is greater than 25 horsepower, or for conversion to other than A1 refrigerant in a system of any size.

1126.3 System Selection. Refrigerants used in replaced, added or converted systems shall be limited in application in accordance with Table 11-2 and the requirements of Section 1105.

1126.4 Refrigerant Sensor and Alarms. A refrigerant-vapor detection system and alarm systems for the specific refrigerant (refer to Section 1107.4) shall be installed and shall utilize alarm signaling devices providing a sound pressure level of at least 15 dBA above the operating ambient noise level within the room and providing a distinctive visual alarm both inside and outside the machinery room at each entrance. The refrigerant sensor shall energize the emergency ventilation system upon detection of refrigerant levels as specified in Section 1108.5.

1126.5 Ventilation. Both continuous and emergency ventilation shall be provided in accordance with Section 1108 to serve the machinery room.

Exception: In the event that compliance with Sections 1108.7 and 1108.9 are physically impractical, a system designed to minimize the hazard of contaminated exhaust shall be prepared and submitted for approval to the Administrative Authority by a professional engineer licensed to practice as such in the State of Texas. Such design is subject to the provisions of Sections 105, 106, and 107.

1126.6 Over pressure Protection. Pressure vessels of replaced, added or refrigerant-converted refrigeration machinery shall be provided with over-pressure protection as specified in Sections 1113, 1114, 1119, and 1120.

1126.7 Machinery Room Construction. Construction joints and penetrations shall be sealed to restrict passage of refrigerant vapor. See Section 1107.5.

Exception: Where it is found to be physically impractical to rehabilitate a machinery room to comply with the above (one or two hour construction), an evaluation and report by a professional engineer licensed to practice as such in the State of Texas shall be submitted to the Administrative Authority for approval, clearly stating measures necessary to attain a reasonably complete fire-rated separation and to minimize the possibility of refrigerant escaping the machinery room into other parts of the building. Such design is subject to the provisions of Sections 105, 106, and 107 of this code. To the extent consistent with the scope of practice authorized under state law, a licensed architect may also render an opinion under this exception.

1126.8 Equipment Identification. Equipment in the machinery room shall be identified as indicated in Section 1122 of this chapter.

1126.9 Ductwork. New ductwork, except for ventilation as required by this chapter and combustion air, is not permitted in an existing refrigeration machinery room. Where it is impractical to relocate existing ducts or it is necessary to add ductwork for combustion air, all joints and seams in both new and existing ductwork shall be sealed substantially air tight. Refer to Section 602.4.

1127.0 Boilers in Existing Machinery Rooms

1127.1 Isolation. Boilers and other heat-producing appliances shall be isolated from the machinery room by walls or partitions which create a reasonably distinct and separate atmosphere from the refrigeration machinery room. Combustion air shall be taken from other than refrigeration machinery rooms in accordance with Chapter 7. Partitions, doors and other components of the structure shall be made of materials as required for not less than a one-hour fire barrier.

Exceptions:

1. Where physically impractical to comply with the above, an evaluation report by a registered engineer licensed to practice as such in the State of Texas shall be presented to the Administrative Authority for approval. Upon approval, the walls, partitions and doors need not comply with requirements set forth for a fire barrier, but may consist of one hour material designed and constructed to isolate the machinery room from the boilers to create a reasonably distinct and separate atmosphere within the respective rooms. To the extent consistent with the scope of practice authorized under state law, a licensed architect may also render an opinion under this exception.
2. Where it found to be physically impractical to construct a separation of boilers and refrigeration machinery containing A1 or B1 refrigerant, an evaluation by a professional engineer licensed to practice as such in the State of Texas shall be made in regard to the effect that ventilation, both emergency and continuous, will have on the operation of boilers within the refrigeration machinery room. A report, including a statement clearly indicating that the boiler will or will not operate safely shall be submitted to the Administrative Authority for review and approval prior to placing the boilers and ventilation into operation simultaneously. If the professional engineer determines that the required continuous ventilation will not have a detrimental effect on the operation of boilers but that emergency ventilation will have a detrimental effect on boiler operation, any approval shall require that an electrical interlock designed to shut off the fuel supply to boilers when emergency ventilation is energized be used in lieu of isolation of the boilers from the machinery room.

1127.2 Engines in Existing Refrigeration Machinery Rooms. Engines are permitted in refrigeration machinery rooms provided:

1. The refrigerant classification is A1 or B1 only;
2. Combustion air is taken from outside the building and to the engine in substantially sealed ducts or pipes;

3. Insulation is provided for all hot surfaces subject to a temperature of 800°F or higher;
4. Ventilation is provided to dissipate the radiant heat from the engines and keep the room below 120°F; and
5. There is no open flame or spark.

1127.3 Switchgear and Related Equipment in Machinery Room. Switchgear and related equipment may remain in an existing machinery room provided:

1. The refrigerant classification is A1 or B1 only; and
2. The switchgear or related equipment possesses no clearance or work hazard in regard to the refrigeration machinery or the electrical switchgear.

1127.4 Emergency Control. Emergency control in accordance with Section 1109.4 shall be provided for the refrigeration equipment and existing air-handling equipment except machinery room ventilation fans.

1128.0 Absorption Refrigeration.

1128.1 Lithium Bromide Absorption Refrigeration. Lithium bromide absorption refrigeration equipment using water as the refrigerant and steam or hot water as the energy source is exempt from refrigeration machinery room requirements and may be located in the same room with refrigeration equipment requiring a machinery room.

1128.2 Direct Fired Absorption Refrigeration. Direct fired absorption refrigeration equipment shall be installed in a room constructed as required for a boiler of similar Btu input. This equipment shall not be installed in a refrigeration machinery room.

1128.3 Ammonia Absorption Refrigeration. Ammonia absorption refrigeration equipment larger than 5 tons shall be installed in a refrigeration machinery room with the relief piped in accordance with Section 1120.

TABLE 11-1
Refrigerant Groups[1], Properties[2] and Allowable Quantities[3]

0.016 = kg/m³

Refrigerant	Chemical Formula	Chemical Name[4] (Composition for Blends)	Chemical Abstract Service Number	Safety Group[1]	PEL[5] (ppm)	IDLH[6] (ppm)	LFL[7] (%V in air)	Specific Gravity (air=1)	Pounds per 1000 cv of Space[8]
R-11	CCl_3F	Trichlorofluoromethane	75-69-4	A1	1000[9]	5000[10]	N/A	4.74	1.60
R-12	CCl_2F_s	Dichlorodifluoromethane	75-71-8	A1	1000	50,000	N/A	4.17	12.00
R-22 R-113	$CHClF_2$ CCl_2FCClF_2	Chlorodifluoromethane 1,1,2-tricholor-1,2,2-trifluoroethane	75-45-6 76-13-1	A1 A1	1000[11] 1000	50,000[12] 4500	N/A	2.99 6.47	9.40 1.90
R-114	$CClF_2CClF_2$	1,2-dichloro-1,1,2,2-trifluoroethane	76-14-1	A1	1000	50,000	N/A	5.90	9.40
R-123	$CHCl_2CF_3$	2,2-dichloro-1,1,1,-trifluoroethane	306-83-2	B1	10[11]	4000[12]	N/A	5.28	1.60
R-134A	CF_3CH_2F	1,1,1,2-tetrafluoroethane	811-97-5	A1	1000[11]	50,000[12]	N/A	3.52	16.00
R-500 —73.8% —26.3%	azeotrope CCl_2F_2 CH_3CF_3	R-12/152a (73.8/26.2) Dichlorodifluoromethane 1,1-difluoroethane	 75-71-8 75-37-6	A1	1,000[11]	50,000[12]	N/A	3.43	16.00
R-502 —48% —51.2%	azeotrope $CHClF_2$ $CClF_2CF_3$	R-22/115 (48.8/51.2) Chlorodifluoroethane 1-chloro=1,1,2,2,2-pentafluoroethane	 75-45-6 76-15-3	A1	1000[11]	50,000[12]	N/A	3.85	19.00
R-717	NH_3	Ammonia	7664-41-7	B2	50[13]	500	15.5	0.59	0.022
R-744	CO_2	Carbon Dioxide	124-38-9	A1	5000	50,000	N/A	1.52	5.70

1 Refrigerant safety group designation is in accordance with Section 1102.0.
2 Refrigerant properties are those needed for this chapter.
3 Allowable quantities are for high-probability systems under Section 1103.0 only.
4 Chemical name shown is the preferred name.
5 PEL is that designated in 29 CFR 1910.1000 unless otherwise indicated.
6 IDLH is that designated by NIOSH unless otherwise designated
7 LFL is percent refrigerant by volume in air at 68°F (20°C) and 29.92 in Hg (101.3 kPa); "not applicable (not flame limits)".
8 Pounds of refrigerant in a high-probability system per 1000 cubic feet (28.3 kg/m³) of occupied space. See Section 1104.0. This column does not apply to refrigerant machinery rooms or areas covered by Section 1106.0.
9 The PEL value shown is the TLV-C recommended by ACGIH.
10 The IDLH value shown is reduced from that designated by NIOSH in light of cardiac sensitization potential.
11 A PEL has not yet been established; the value given was determined in a consistent manner.
12 An IDLH has not yet been established; the value given was determined in a consistent manner.
13 OSHA PEL is 50 ppm; ACGIH TLV-TWA is 25 ppm.

TABLE 11-1
REFRIGERANT CLASSIFICATION, AMOUNT AND TLV-TWA

Refrigerant	Chemical Formula	Chemical Name or Brand	Hazard Categories[a]	Refrigerant Classification	Degrees of Hazard[b]	Amount of Refrigerant per Occupied Space			TLV-TWA (ppm)
						Lbs. Per 1000 cu. ft.	ppm	g/m	
R-11	$CC1_3F$	Trichlorofluormethane	OHH	A1	2-0-0[c]	1.6	4,000	25	C1,000
R-12	$CC1_2F_2$	Dichlorodifluoromethane	CG, OHH	A1	2-0-0[c]	12	40,000	200	1,000
R-13	$CC1F_3$	Chlorotrifluoromethane	CG, OHH	A1	2-0-0[c]	18	67,000	290	1,000
R-13B1	$CBrF_3$	Bromotrifluoromethane	CG, OHH	A1	2-0-0[c]	22	57,000	350	1,000
R-14	CF_4	Tetrafluoromethane (carbon tetrafluoride)	CG, OHH	A1	2-0-0[c]	15	67,000	240	1,000
R-22	$CHC1F_2$	Chlorodifluoromethane	CG, OHH	A1	2-0-0[c]	9.4	42,000	150	1,000
R-23	CHF_3	Trifluoromethane (fluoroform)	CG, OHH	A1	2-0-0[c]	--	--	--	--
R-113	$CC1_2FCC1F_2$	1,1,2-trichloro-1,2,2-trifluorethane	OHH	A1	2-0-0[c]	1.9	4,000	31	1,000
R-114	$CC1F_2CC1F_2$	1,2-dichloro-1,1,2,2-tetrafluoroethane	CG, OHH	A1	2-0-0[c]	9.4	21,000	150	1,000

Refrigerant	Chemical Formula	Chemical Name or Brand	Hazard Categories[a]	Refrigerant Classification	Degrees of Hazard[b]	Amount of Refrigerant per Occupied Space			TLV-TWA (ppm)
						Lbs. Per 1000 cu. ft.	ppm	g/m	
R-123	$CHC1_2CF_3$	2,2-dichloro-1,1,1-trifluoroethane	OHH	B1	2-0-0[c]	0.4	1,000	6.3	30
R-124	$CHC1FCF_3$	2-chloro-1,1,1,2-tetrafluoroethane	CG, OHH	A1	2-0-0[c]	--	--	--	--
R-134a	CH_2FCF_3	1,1,1,2-tetrafluorethane	CH, OHH	A1	2-0-0[c]	16	60,000	250	1,000
R-170	CH_3CH_3	Ethane	CG, F, OHH	A3	2-4-0	0.50	6,400	8.0	1,000
R-236fa	CF_3,CH_2,CF_3	1,1,1,3,3,3-hezafluoropropane	CG, OHH	A1	2-0-0[c]	--	--	--	--
R-245fa	CHF_2,CH_2CF_3	1,1,1,3,3-pentafluoropane	CG, OHH	A1	2-0-0[c]	--	--	--	--
R-290	$CH_3CH_2CH_3$	Propane	CG, F, OHH	A3	2-4-0	.50	4,400	8.0	1,000
R-400	Zoetrope	R-12/114	CG, OHH	A1	2-0-0[c]	--	--	--	--
R-401A	Zoetrope	R-22/152a/124 (53/13/34)	CG, OHH	A1	2-0-0[c]	--	--	--	--

Refrigerant	Chemical Formula	Chemical Name or Brand	Hazard Categories[a]	Refrigerant Classification	Degrees of Hazard[b]	Amount of Refrigerant per Occupied Space			TLV-TWA (ppm)
						Lbs. Per 1000 cu. ft.	ppm	g/m	
R-401B	Zoetrope	R-22/152a-124 (61/11/28)	CG, OHH	A1	2-0-0[c]	--	--	--	--
R-401C	Zoetrope	R-22/152a/124 (33/15/52)	CG, OHH	A1	2-0-0[c]	--	--	--	--
R-402A	Zoetrope	R-125/290/22 (60/2/38)	CG, OHH	A1	2-0-0[c]	--	--	--	--
R-402B	Zoetrope	R-125/290/22 (38/2/60)	CG, OHH	A1	2-0-0[c]	--	--	--	--
R-404A	Zoetrope	R-125/143a/134a (44/52/4)	CG, OHH	A1	2-0-0[c]	--	--	--	--
R-407A	Zoetrope	R-32/125/134a (20/40/40)	CG, OHH	A1	2-0-0[c]	--	--	--	--
R-407B	Zoetrope	R-32/125/134a (10/70/20)	CG, OHH	A1	2-0-0[c]	--	--	--	--
R-407C	Zoetrope	R-32/125/134a 923/25/52)	CG, OHH	A1	2-0-0[c]	--	--	--	--
R-407D	Zoetrope	R-32/125/134a (15/15/70)	CG, OHH	A1	2-0-0[c]	--	--	--	--

Refrigerant	Chemical Formula	Chemical Name or Brand	Hazard Categories[a]	Refrigerant Classification	Degrees of Hazard[b]	Amount of Refrigerant per Occupied Space			TLV-TWA (ppm)
						Lbs. Per 1000 cu. ft.	ppm	g/m	
R-407E	Zoetrope	R-32/125/134a (25/15/60)	CG, OHH	A1	2-0-0[c]	--	--	--	--
R-408A	Zoetrope	R-125/143a/22 (7/46/47)	CG, OHH	A1	2-0-0[c]	--	--	--	--
R-409A	Zoetrope	R-22/124/142b (60/25/15)	CG, OHH	A1	2-0-0[c]	--	--	--	--
R-409B	Zoetrope	R-22/124/142b (62/25/10)	CG, OHH	A1	2-0-0[c]	--	--	--	--
R-410A	Zoetrope	R-32/125 (50/50)	CG, OHH	A1	2-0-0[c]	--	--	--	--
R-416A	Zoetrope	R-134a/124/600 (59/39.5/1.5)	CG, OHH	A1	2-0-0[c]	--	--	--	--
R-500	Azeotrope	R-12/152a (73.8/26.2)	CG, OHH	A1	2-0-0[c]	12	47,000	200	1,000
R-502	Azeotrope	R-22/115 (48.8/51.2)	CG, OHH	A1	2-0-0[c]	19	65,000	300	1,000
R-503	Azeotrope	R-23/13 (40.1/59.9)	CG, OHH	A1	2-0-0[c]	15	67,000	240	1,000

Refrigerant	Chemical Formula	Chemical Name or Brand	Hazard Categories[a]	Refrigerant Classification	Degrees of Hazard[b]	Amount of Refrigerant per Occupied Space			TLV-TWA (ppm)
						Lbs. Per 1000 cu. ft.	ppm	g/m	
R-507A	Azeotrope	R-125/143a (50/50)	CG, OHH	A1	2-0-0[c]	--	--	--	--
R-508A	Azeotrope	R-23/116 (39/61)	CG, OHH	A1	2-0-0[c]	--	--	--	--
R-508B	Azeotrope	R-23/116 (46/54)	CG, OHH	A1	2-0-0[c]	--	--	--	--
R-509A	Azeotrope	R-22/218 (44/56)	CG, OHH	A1	2-0-0[c]	--	--	--	--
R-600	$CH_3CH_2CH_2CH_3$	Butane	CG, F, OHH	A3	1-4-0[c]	.051	3,400	8.2	800
R-600a	$CH(CH_3)2-CH_3$	Isobutane (2-methyl propane)	CG, F, OHH	A3	2-4-0	.051	3,400	8.2	800
R-717	NH_3	Ammonia	CG, C, F, OHH	B2	3-3-0[d]	0.022	500	0.35	25
R-718	H_2O	Water	---	A1	0-0-0	--	--	--	--
R-744	CO_2	Carbon dioxide	CG, OHH	A1	2-0-0[c]	5.7	50,000	91	5,000

Refrigerant	Chemical Formula	Chemical Name or Brand	Hazard Categories[a]	Refrigerant Classification	Degrees of Hazard[b]	Amount of Refrigerant per Occupied Space			TLV-TWA (ppm)
						Lbs. Per 1000 cu. ft.	ppm	g/m	
R-1150	$CH_2=CH_2$	Ethene (ethylene)	CG, F, OHH	A3	1-4-2	0.38	5,200	6.0	1,000
R-1270	$CH_3CH=CH_2$	Propene (propylene)	CG,F,OHH	B3	1-4-1	0.37	3,400	5.0	1,000

For SI: 1 pound= 0.454 kg, 1 cubic foot = 0.0283 m^3.

1. CG = compressed gas; C= Corrosive; F= Flammable; OHH= Other Health Hazard
2. Degrees of hazard are for health, fire, and reactivity, respectively, in accordance with NFPA 704.
3. Reduction to 1-0-0 is allowed if an analysis satisfactory to the administrative authority shows that the maximum concentration for a rapture or full loss of refrigerant charge would not exceed the IDLH, considering both the refrigerant quantity and room volume.
4. For installations that are entirely outdoors, use 3-1-0.

TABLE 11-5
MINIMUM PIPE INSULATION

PIPING SYSTEM TYPES	FLUID TEMPERATURE RANGE, °F	PIPE SIZES[a]					
		Runouts up to 2"[b]	1" and less	1.25" to 2"	2.5" to 4"	5" to 6"	8" and larger
HEATING SYSTEMS							
Steam and hot water:							
High pressure/temperature	306-450	1 1/2	2 ½	2 ½	3	3 ½	3 ½
Medium pressure/temperature	251-305	1 ½	2	2 ½	2 ½	3	3
Low pressure/temperature	201-250	1	1 ½	1 ½	2	2	2
Low temperature	106-200	½	1	1	1 ½	1 ½	1 ½
Steam condensate (for feed water)	Any	1	1	1 ½	2	2	2
COOLING SYSTEMS							
Chilled water, refrigerant and brine	40-55	½	½	3/4	1	1	1
	Below 40	1	1	1 ½	1 ½	1 ½	1 ½

Part II – Cooling Towers

~~1126.0~~ 1129.0 General

Cooling towers, evaporative condensers and fluid coolers shall be readily accessible. When located on roofs, such equipment, having combustible exterior surfaces, shall be protected with an approved automatic fire-extinguishing system.

~~1127.0~~ 1130.0 Support and Anchorage

Cooling towers, evaporative condensers and fluid coolers shall be supported on noncombustible grillage designed in accordance with the Building Code. Seismic restraints shall be as required by the Building Code.

~~1128.0~~ 1131.0 Water Supply

Water supplies and backflow protection shall be as required by the ~~Uniform~~ Plumbing Code.

~~1129.0~~ 1132.0 Drainage

Drains, overflows and blow-down provisions shall have indirect connection to an approved disposal location. Discharge of chemical waste shall be as approved by the appropriate regulatory authority.

~~1130.0~~ 1133.0 Chemical Treatment Systems

Chemical treatment systems shall comply with the Fire Code. When chemicals used present a contact hazard to personnel, approved emergency eye-wash ~~and shower~~ facilities shall be installed.

~~1131.0~~ 1134.0 Location

Cooling towers, evaporative condensers and fluid coolers shall be located such that their plumes cannot enter occupied spaces. Plume discharges shall be at least five (5) feet (1524 mm) above or twenty (20) feet (6096 mm) away from any ventilation inlet to a building. Location on the property shall be as required for buildings by the Building Code.

~~1132.0~~ 1135.0 Electrical

Electrical systems shall be in accordance with the Electrical Code. Equipment shall be provided with a vibration switch to shut off fans operating with excessive vibration. In climates commonly subject to electrical storms, lightening protection shall be provided on roof-mounted equipment.

~~1133.0~~ 1136.0 Refrigerants and Hazardous Fluids

Equipment containing refrigerants as a part of a closed-cycle refrigeration system shall comply with Part I of this chapter. Equipment containing other fluids which are flammable, combustible or hazardous shall comply with the Fire Code.

~~**1201.2.1.4.2.1 Mechanically Formed Tee Fittings.** Mechanically extracted collars shall be formed in a continuous operation consisting of drilling a pilot hole and drawing out the tube surface to form a collar having a height not less than three times the thickness of the branch tube wall.~~

~~The branch tube shall be notched to conform with the inner curve of the run tube and have two dimple/depth stops to insure that penetration of the branch tube into the collar is of sufficient depth for brazing and that the branch tube does not obstruct the flow in the main line tube. Dimple/depth stops shall be in line with the run of the tube. The second dimple shall be 1/4 inch (6.35 mm) above the first and shall serve as a visual point of inspection. All joints shall be brazed in accordance with Section 212.0. Soft soldered joints shall not be allowed.~~

1201.2.8.3 Pressure Test. Piping shall be tested with a hydrostatic pressure of not less than 100 psig (689 kPa), but at least fifty (50) psig (345 kPa) greater than operating pressure. This pressure shall be maintained for at least thirty (30) minutes. Required tests shall be conducted by the owner or contractor in the presence of an authorized inspector or licensed professional engineer. The piping being tested shall remain exposed to the inspector and shall not leak during the test.

Exception: Chilled water piping.

1201.3 Reserved. ~~Those portions of the hot-water piping systems in which the continuous pressure-temperature relationship does not exceed the following may be constructed of polybutylene pipe or tubing of SDR-11 conforming to specification ASTM D 3309.~~

~~Temperature, °F (°C) Pressure, psi (kPa)~~

~~73 (23) 200 (1379)~~

~~180 (82) 100 (689)~~

~~200 (93) 8 (55)~~

~~Polybutylene also may be used for applications requiring up to one year total exposure at conditions of 210°F (99°C), 150 psi (1027 kPa), typical conditions for temperature and pressure-relief valve discharge lines in heating systems.~~

~~1201.3.1 Materials and Construction~~

~~**1201.3.1.1 PB Pipe and Tubing.** Pipe shall be IPS or copper tube size polybutylene, both SDR-11 conforming to ASTM D 3309.~~

~~**1201.3.1.2 Fittings.** Fittings shall be of polybutylene or metal.~~

~~**1201.3.1.3 Insulation.** Coverings and insulation used on hot-water pipes shall be of materials suitable for the operating temperature of the system. The insulation, jackets and lap-seal adhesives shall be tested as a composite product and shall have a flame spread of not more than 25 and a smoke-developed rating of not more than 50 when tested in accordance with building code standards.~~

~~**1201.3.1.4 Gaskets.** Flanged PB systems may be installed without gaskets.~~

~~**1201.3.1.5 Hangers, Sleeves and Anchors.** Hangers, sleeves and anchors shall be suitable for the use intended as recommended by the manufacturer's installation instructions.~~

~~**1201.3.1.6 Standards.** All piping, tubing, valves, joints, fittings, devices and materials shall be free of defects and comply with nationally recognized standards approved by the Administrative Authority.~~

~~**1201.3.1.7 Marking.** Materials and devices shall be suitably identified.~~

1201.3.2 Fabrication of Joints. Joints shall be made by one or more of the following methods:

1201.3.2.1 Socket Fusion. Polybutylene socket fittings may be heat fused to the pipe.

1201.3.2.2 Crimp/Insert Fittings. Insert fittings of metal with crimp rings of aluminum or copper may be used.

1201.3.2.3 Compression Fittings. Metallic or polybutylene fittings utilizing compression seals are acceptable.

1201.3.2.4 Transition Fittings. Connections to other piping materials shall be made by approved types of special transition fittings.

1201.3.3 Changes in Direction. Changes in direction shall be made by the appropriate use of fittings or with pipe bends having a radius of not less than 10 diameters of the pipe. No forming equipment or heating is required.

1201.3.4 Hangers and Supports. Piping and equipment shall be adequately supported to the satisfaction of the Administrative Authority. Hot water piping shall be supported, anchored and provided with swing joints, expansion loops or joints, or utilize the pipe's flexibility to avoid excessive strain on piping, equipment or the building structure to the satisfaction of the Administrative Authority.

1201.3.5 Installation Details

1201.3.5.1 Piping Embedded in Structure. Piping shall not be built into or embedded in concrete or masonry, except where used for radiant panel heating or cooling. See Part II of this chapter.

~~**1201.3.5.2 Cutting Structure.** Structural members shall not be seriously weakened or impaired by cutting or notching.~~

~~**1201.3.5.3 Under Walls or Foundations.** All piping passing under load-bearing foundations shall be protected by sleeving.~~

~~**1201.3.5.4 Openings into Buildings.** Voids around piping passing through concrete or masonry floors or walls shall be appropriately sealed at the opening into the building. Sleeves shall be provided at such openings.~~

~~**1201.3.5.5 Aboveground Piping**~~

~~**1201.3.5.5.1 Sleeves.** Sleeves shall be installed where piping passes through masonry or concrete, or through any fire separation.~~

~~**1201.3.5.5.2 Insulation.** The temperature of surfaces within normal reach of building occupants shall not exceed 140°F (60°C), unless they are protected by suitable insulation. Where sleeves are installed, any insulation shall continue full sized through them.~~

~~**1201.3.5.6 Belowground Piping**~~

~~**1201.3.5.6.1 Protection of Structure.** All trenches deeper than the footings of any building or structure and paralleling the same shall be at least 45 degrees there from, unless otherwise permitted by the Administrative Authority.~~

~~**1201.3.5.6.2 Mechanical Equipment.** Use of mechanical excavating equipment is prohibited within two (2) feet (609.6 mm) of existing piping or appurtenances.~~

1201.3.5.6.3 Boring and Pulling. Boring pipe shall be at least one size larger than the pipe to be laid. Pulling force shall not exceed the tensile yield strength of the pipe.

1201.3.5.6.4 Backfilling. All excavations shall be completely backfilled as soon after inspection as practicable. Adequate precaution shall be taken to ensure proper compaction of the backfill around piping without damage to such piping. Trenches shall be backfilled in thin layers to twelve (12) inches (304.8 mm) above the top of the piping with clean earth which shall not contain stones, boulders, cinder fill or other materials which would damage or break the piping. Mechanical devices such as bulldozers, graders, etc., may then be used to complete backfill to grade. Fill shall be properly compacted. Suitable precautions shall be taken to ensure permanent stability for pipe laid in filled or made ground.

1201.3.5.6.5 Pipe or Tube under Concrete. Pipe or tubing installed beneath footings or slabs shall be in continuous lengths or with fused joints.

1201.3.6 Pressure Testing

1201.3.6.1 Responsibility. The equipment, material and labor necessary for inspection or test shall be furnished by the person to whom the permit is issued or by whom inspection is requested.

1201.3.6.2 Media. The piping shall be tested with water.

1201.3.6.3 Pressure Test. Piping shall be tested with a hydrostatic pressure of not less than 100 psig (689 kPa) or 1.5 times the system design operating pressure. The pressure shall be maintained for 30 minutes, at which time the indicated pressure may have decreased due to the initial expansion of the pipe. After 30 minutes, adjust the system to the required pressure and visually inspect for leaks. Required tests shall be conducted by the owner or contractor in the presence of an

~~authorized inspector. The piping being tested shall remain exposed to the inspector and shall not leak during the test.~~

CHAPTER 14

~~PROCESS PIPING~~

RESERVED

~~1401.0 General~~

~~The regulations of this chapter shall govern the installation of process piping in or in conjunction with a building or structure or located upon the premises.~~

~~1402.0 Definitions~~

~~For the purposes of this chapter, certain terms, phrases, words, and their derivatives shall be interpreted as set forth in this section.~~

~~**APPROVED.** See Section 203.0.~~

~~**EMERGENCY ALARM SYSTEM** is a system intended to provide the indication and warning of abnormal conditions and summon appropriate aid.~~

~~**EMERGENCY CONTROL STATION** is an approved location on the premises where signals from emergency equipment are received.~~

~~**FABRICATION AREA (FAB AREA)** is an area within a Group H Occupancy semiconductor fabrication facility and related research and development areas in which there are processes involving hazardous production materials. Such areas are allowed to include ancillary rooms or areas such as dressing rooms and offices that are directly related to the fab area processes.~~

~~**HAZARDOUS PROCESS PIPING (HPP)** is a process material piping or tubing conveying a liquid or gas that has a degree of hazard rating in health, flammability or reactivity of Class 3 or 4, as ranked by the Fire Code.~~

~~**HPM STORAGE ROOM** is a room used for the storage or dispensing of hazardous production material (HPM) and which is classified as a Group H, Division 1 or Division 2 Occupancy.~~

NONHAZARDOUS PROCESS PIPING (NPP) is production material piping or tubing conveying a liquid or gas which is not classified as hazardous production material piping.

PROCESS PIPING is piping or tubing which conveys liquid or gas and which is used directly in research, laboratory or production processes and which is not regulated under the mechanical or plumbing code.

SERVICE CORRIDOR is a fully enclosed passage used for transporting hazardous production materials and purposes other than required exiting.

USE (MATERIAL) is the placing in action or making available for service by opening or connecting any container utilized for confinement of material, whether a solid, liquid or gas.

1403.0 Permit

It shall be unlawful to install, alter or repair or cause to be installed, altered or repaired any process material piping without first obtaining a permit.

Permits for process piping shall show the total number of outlets to be provided for on each system and such other information as may be required by the Administrative Authority.

Fees for process piping permits are included in Table 1-1.

1404.0 Plans Required

Plans, engineering calculations, diagrams and other data shall be submitted in one or more sets with each application for a permit. The Administrative Authority may require plans, computations and specifications to be prepared and designed by an engineer licensed by the state to practice as such.

When plans or other data are submitted for review, a plan review fee shall be paid, as provided in Section 115.3.

1405.0 Workmanship

Process piping shall not be strained or bent, nor shall tanks, vessels, vats, appliances or cabinets be supported by or develop strain or stress on the piping.

1406.0 Inspections

1406.1 General. Upon completion of the installation, alteration or repair of process piping, and prior to the use thereof, the Administrative Authority shall be notified that such piping is ready for inspection.

Excavations required for the installation of underground piping shall be kept open until such time as the piping has been inspected and approved. If any such piping is covered or concealed before such approval, it shall be exposed upon the direction of the Administrative Authority.

1406.2 Required Inspections. The Administrative Authority shall make the following inspections and shall either approve that portion of the work as completed, or shall notify the permit holder wherein the same fails to comply with this code.

1406.2.1 Rough Piping Inspection. This inspection shall be made after all process piping authorized by the permit has been installed, and before any such piping has been covered or concealed. This inspection shall include a determination that the piping size, material and installation meet the requirements of this code.

1406.2.2 Final Piping Inspection. This inspection shall be made after all piping authorized by the permit has been installed and after all portions thereof which are to be covered or concealed are so concealed. This inspection shall include a pressure test, at which time the piping shall stand a pressure of not less than one and one half times the maximum designed operating pressure when hydraulic testing is conducted or 110 percent when testing is conducted pneumatically. Test pressures shall be held for a length of time satisfactory to the Administrative Authority, but in no case for less than 30 minutes with no perceptible drop in pressure. HPM drain, waste, and vent piping shall be tested in accordance with the Plumbing Code. Tests shall be made in the presence of the Administrative Authority. Necessary apparatus for conducting tests shall be furnished by the permit holder.

1406.3 Other Inspections. In addition to the inspections required by this section, the Administrative Authority may require a special inspector, as specified in the Building Code, during installation of piping systems. In cases where the work authorized was installed in accordance with plans and specifications prepared by an engineer, the Administrative Authority may require a final signed report stating that the work was installed in accordance with the approved plans and specifications and the applicable provisions of this chapter.

1407.0 Piping and Tubing

1407.1 General. Process piping and tubing shall comply with this subsection and shall be installed in accordance with nationally recognized standards. Piping and tubing systems shall be metallic unless the material being transported is incompatible with such system.

1407.2 Hazardous Process Piping (HPP)

1407.2.1 General. HPP supply piping or tubing in service corridors shall be exposed to view. HPP piping shall be identified in accordance with nationally recognized standards to indicate the material being transported. All liquid HPP piping shall have an approved means for directing any spilled materials to an approved containment or drainage system.

All liquid HPP waste or drainage systems shall be installed in accordance with the plumbing code.

1407.2.2 Installation in Exit Corridors and Above Other Occupancies. Hazardous process supply pipe shall not be located within exit corridors, within any portion of a means of egress required to be enclosed in fire-resistive construction or in concealed spaces in or above areas not classified as Group H Occupancies, except as permitted by this subsection.

Hazardous production material piping and tubing may be installed within the space defined by the walls of exit corridors and the floor or roof above or in concealed spaces above other occupancies under the following conditions:

~~**1407.2.2.1** Automatic sprinklers shall be installed within the space, unless the space is less than six (6) inches (152 mm) in least dimension.~~

~~**1407.2.2.2** Ventilation at not less than six air changes per hour shall be provided. The space shall not be used to convey air from any other area.~~

~~**1407.2.2.3** When the piping or tubing is used to transport HPP liquids, a receptor shall be installed below such piping or tubing. The receptor shall be designed to collect any discharge or leakage and drain it to an approved location. The one-hour enclosure shall not be used as part of the receptor.~~

~~**1407.2.2.4** All HPP supply piping and tubing and HPP nonmetallic waste lines shall be separated from the exit corridor and from any occupancy other than semiconductor fabrication facility classified as a Group H Occupancy by construction as required for walls or partitions that have a fire-protection rating of not less than one hour. When gypsum wallboard is used, joints on the piping side of the enclosure need not be taped, provided the joints occur over framing members. Access openings into the enclosure shall be protected by approved fire assemblies.~~

~~**1407.2.2.5** Readily accessible manual or automatic remotely activated fail-safe emergency shutoff valves shall be installed on piping and tubing other than waste lines at the following locations:~~

~~**1407.2.2.5.1** At branch connections into the fabrication area.~~

~~**1407.2.2.5.2** At entries into exit corridors.~~
~~Excess flow valves shall be installed as required by the Fire Code.~~

1407.2.2.6 Electrical wiring and equipment located in the piping space shall be approved for Class I, Division 2, Hazardous Locations.

Exception: Occasional transverse crossing of the corridors by supply piping which is enclosed within a ferrous pipe or tube for the width of the corridor need not comply with Items 1407.2.2.1 through 1407.2.2.6.

1407.3 Special Requirements for HPP Gases

1407.3.1 General. In addition to other requirements of this section, HPP gases shall comply with this subsection and the Fire Code.

1407.3.2 Special Provisions

1407.3.2.1 Excess Flow Control. Where HPP supply gas is carried in pressurized piping, a fail-safe system shall shut off flow due to a rupture in the piping. Where the piping originates from outside the building, the valve shall be located outside the building as close to the bulk source as practical.

1407.3.2.2 Piping and Tubing Installation. Piping and tubing shall be installed in accordance with approved standards. Supply piping for hazardous production materials having a health hazard ranking of 3 or 4 shall have welded connections throughout, unless an exhausted enclosure is provided.

Exception: Material which is incompatible with ferrous piping may be installed in nonmetallic piping with approved connections.

1407.3.2.3 Gas-Detection System. When hazardous production material gas is used or dispensed and the physiological warning properties for the gas are at a higher level than the accepted permissible exposure limit for the gas, a continuous gas-monitoring system shall be provided to detect the presence of a short-term hazard condition. When dispensing occurs and flammable gases or vapors may be present in quantities in excess of 20 percent of the lower explosive limit, a

~~continuous gas-monitoring system shall be provided. The monitoring system shall be connected to the emergency control station.~~

CHAPTER 15

~~SOLAR SYSTEMS~~

RESERVED

~~See Section 1206.0, Heat Sources, and the Uniform Solar Energy Code, published by the International Association of Plumbing and Mechanical Officials. The Uniform Solar Energy Code provides requirements which may be adopted as part of the code by the Administrative Authority.~~